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ABSTRACT

This articulation instructional objective guide for automotive mechanics contains summary information on fifteen blocks (courses) of instruction. They are introduction to automotive technology; lubrication and vehicle operating maintenance; cooling system maintenance and repair; automobile heater maintenance and repair; braking system maintenance and repair; fuel system, maintenance and repair; steering and front-end maintenance and repair; drive train with manual transmission maintenance and repair; engine maintenance, repair, and overhaul; automobile heater and air conditioner maintenance and repair; automatic transmission maintenance and repair; electrical systems maintenance and repair; automotive servicing; automotive cooperative training; and automotive emissions control. Information for the instructional blocks include these elements: list of job tasks, course description, instructional hours, instructional objectives, skills and related technical information to be taught, performance standards, standardized performance test items, and equipment requirements. Also included are recommended academic subjects for high school and community college/technical institute auto mechanics curriculum and job task listing for auto mechanics. Also available are the Final Report (CE 019 107), Policy and Procedures Guide (CE 019 108), and Instructional Objectives Guides (CE 019 109-110). (JH)

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STATE ARTICULATED INSTRUCTIONAL OBJECTIVES GUIDE

FOR

OCCUPATIONAL EDUCATION PROGRAMS

STATE PILOT MODEL

FOR

AUTOMOTIVE MECHANICS (DCC V-003)

AND

AUTOMOTIVE MECHANICS (HIGH SCHOOL)

PREPARED BY

ARTICULATION OF OCCUPATIONAL EDUCATION PROGRAMS
BETWEEN SECONDARY SCHOOLS AND TECHNICAL INSTITUTES/
COMMUNITY COLLEGES PROJECT
c/o JAMES SPRUNT INSTITUTE
P. O. BOX 398, KENANSVILLE, N. C. 28349

AUGUST 1977

A JOINT RESEARCH PROJECT SPONSORED BY
THE NORTH CAROLINA STATE DEPARTMENT OF PUBLIC INSTRUCTION

AND

THE NORTH CAROLINA STATE DEPARTMENT OF COMMUNITY COLLEGES

CE 017 111

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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FOREWORD

This articulated instructional objectives guide is designed for use as a reference in the articulation of occupational programs and to foster competency based instruction and evaluation. It is intended primarily for use by instructors at the post-secondary level and teachers at the secondary level conducting like courses in the same occupational program. The guide considers commonalities in like occupational courses between high school and CC/TI (Community Colleges/Technical Institutes) programs in the same occupation and implements three basic concepts.

The commonality exists by virtue of the requirement by law that North Carolina community colleges and technical institutes conduct "Open Door" instruction in occupational programs. Obviously, such instruction must start from the beginning of the total occupational program, often resulting in duplication of instruction conducted in high school. This fact created the requirement for articulation which, if properly conducted, removes the need for the post-secondary student to repeat occupational instruction successfully completed at the secondary level. Such students usually require only the more advanced occupational instruction not received in their high school.

The three basic concepts involved in occupational program articulation between secondary and post-secondary levels of education are:

1. To ensure that occupational instruction conducted at the high school level is transferable for credit to the CC/TI in the same occupational program, it is essential that the occupational instruction components (courses) content be standardized so as to be identifiable with one or more like components at the CC/TI level.

2. To ensure that the student has acquired sufficient skill in job task performance to be given post-secondary credit for high school work, the teachers and instructors must both use the same task performance standards.

3. To ensure that student occupational qualification recognized for employment or course credit is both valid and reliable, it is necessary to standardize test items and procedures in the evaluation of student job task performance.

Instructional content standardization is based upon job tasks considered necessary for job qualification by the employers. The performance standards standardization is based upon the performance standards required by the industry, business or profession for initial job entry qualification. The ability to perform job tasks and meet initial job entry task performance standards recognized and accepted by employers must take precedence over personal opinions regarding standards or articulation cannot be readily accomplished. Test items and evaluation procedures for the same job task should be developed jointly by the instructors and teachers concerned.

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Summary Block 2.0 (Cooling System Maintenance and Repair) 2.00

Summary Block 3.0 (Automobile Heater Maintenance and Repair) 3.00

Summary Block 4.0 (Braking System Maintenance and Repair) 4.00

Summary Block 5.0 (Fuel System Maintenance and Repair) 5.00

Summary Block 6.0 (Steering and Front End Maintenance and Repair) . . 6.00

Summary Block 7.0 (Drive Train with Manual Transmission Maintenance and Repair) 7.00

Summary Block 8.0 (Engine Maintenance, Repair and Overhaul) 8.00

Summary Block 9.0 (Automobile Heater and Air Conditioner Maintenance and Repair) 9.00

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ARTICULATION RESEARCH PROJECT
ARTICULATION OF OCCUPATIONAL EDUCATION PROGRAMS BETWEEN
SECONDARY SCHOOLS AND TECHNICAL INSTITUTES/COMMUNITY COLLEGES PROJECT
c/o JAMES SPRUNT INSTITUTE, P. O. BOX 398
KENANSVILLE, NC 28349

Instructional Objectives Guide August 1977

PROGRAM: Automotive Mechanics (DCC - 003)
(DPI - High Schools - Automotive Mechanics)

COURSES:
- Introduction to Automotive Technology (Block 0.0)
- Lubrication and Vehicle Operating Maintenance (Block 1.0)
- Cooling System Maintenance and Repair (Block 2.0)
- Automobile Heater Maintenance and Repair (Block 3.0)
- Braking System Maintenance and Repair (Block 4.0)
- Fuel System Maintenance and Repair (Block 5.0)
- Steering and Front End Maintenance & Repair (Block 6.0)
- Power Train and Manual Transmission and Repair (Block 7.0)
- Engine Maintenance, Repair and Overhaul (Block 8.0)
- Automotive Air Conditioner Maintenance and Repair (Block 9.0)
- Automatic Transmission Maintenance and Repair (Block 10.0)
- Electrical Systems Maintenance and Repair (Block 11.0)
- Automotive Servicing (Block 12.0)
- Automotive Cooperative Training (Block 13.0) (Optional)
- Automotive Emissions Control (Block 14.0)

COURSE IDENTIFICATION: (Current Departmental Course Numbers, Like Courses)

Department of Public Instruction:
- Introduction to Automotive Technology (Part of) T & I No. 7391 & 7392
- Lubrication and Vehicle Operating Maintenance (Part of) T & I No. 7413
- Cooling System Maintenance and Repair (Part of) T & I No. 7393
- Automobile Heater Maintenance and Repair (Not Identified)
- Braking System Maintenance and Repair (Part of) T & I No. 7393
- Fuel System Maintenance and Repair (Part of) T & I No. 7393
- Steering and Front End Maintenance and Repair (Part of) T & I No. 7393
- Power Train with Manual Transmission (Part of) T & I No. 7393
- Engine - Maintenance, Repair, and Overhaul (Part of) T & I No. 7403 & 7393
- Automobile Air Conditioner Maintenance and Repair (Not Identified)
- Automatic Transmission Maintenance and Repair (Part of) T & I No. 7393
- Automotive Electrical Systems Maintenance and Repair (Part of) T & I No. 7403 & 7393
- Automotive Servicing (Part of) T & I No. 7393
- Automotive Cooperative Training (Not Taught)
- Automotive Emissions Control (Not Taught)

Department of Community Colleges:
- Introduction to Automotive Technology - AUT 1100
- Lubrication and Vehicle Operating Maintenance (Part of) AUT 1100
- Cooling System Maintenance and Repair (Part of) AUT 1100
- Automobile Heater Maintenance and Repair (Part of) AHR 1101 & AUT 1101
- Braking System Maintenance and Repair-AUT 1121

Fuel System Maintenance and Repair (Part of) AUT 1102
Steering and Front End Maintenance and Repair (Part of) AUT 1123
Power Train with Manual Transmission (Part of) AUT 1124
Engine - Maintenance, Repair and Overhaul (Part of) AUT 1101
Automobile Air Conditioner Maintenance and Repair - AHR 1101
Automatic Transmissions Maintenance and Repair (Part of) AUT 1124
Automotive Electrical Systems Maintenance and Repair (Part of) AUT 1102 & PME 1202
Automotive Servicing - AUT 1125
Automotive Cooperative Training - AUT 1200
Automotive Emissions Control - PME 1133

AUTOMOTIVE MECHANICS INSTRUCTIONAL CONTACT HOURS TOTAL (TECHNICAL ONLY):

High Schools - 1080 Hours
CC/TI - (One Year Diploma) 1045 Hours
- (Two Year Diploma) 1639 Hours
- (With Cooperative Training) 2068 Hours

INSTRUCTIONAL OBJECTIVES: AUTOMOTIVE MECHANICS COURSES, WITH BLOCK CONTACT HOURS

Block 0.0 (180 HRS/176HRS) (HS/CCTI)	Introduction to Automotive Technology: Sub-Block 0.1 - To provide the learner with related technical information and to develop skills regarding: shop safety hazards, shop safety practices, first aid requirements for shop injuries; purpose, use and maintenance of common shop tools, equipment and machinery, performance requirements of Standard Shop Operating Procedures. Identification and uses of automotive fasteners. Sub-Block 0.2 - To provide the learner with related technical information and to develop skills regarding: identification, purpose, mechanical operation, and operator maintenance requirements of the modern automobile, its major assemblies, and the primary components of those assemblies. Sub-Block 0.3 - To provide vocational information pertaining to: The Automotive Maintenance Industry; interpersonal relationships of the mechanic with employers/supervisors, the customer, his fellow workers, and his craft.
Block 1.0 (25 HRS/25HRS)	Lubrication and Vehicle Operating Maintenance: To provide the learner with the skills and related technical information required for qualification to perform oil changes, vehicle lubrication, tire replacement and repair, road service and towing, and winterization of vehicles, according to manufacturer's specifications and to meet minimum industry performance standards.
Block 2.0 (30 HRS/30HRS)	Cooling System Maintenance and Repair: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, maintain, remove and replace automotive cooling systems components; according to manufacturer's specifications and to meet minimum industry performance standards.

Block 3.0 (30 HRS/30 HRS) (To be taught concurrently with Block 9.0-Automobile Air Conditioner)	Automobile Heater Maintenance and Repair: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, maintain, service, remove, and replace the automotive heater, as an item separate from the air conditioner; according to manufacturer's specifications and to meet minimum industry performance standards.
Block 4.0 (60 HRS/66 HRS)	Braking System Maintenance and Repair: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, adjustment, repair, and replacement of components of the automotive braking system; according to manufacturer's specifications and to meet minimum industry performance standards.
Block 5.0 (55 HRS/55 HRS)	Fuel System Maintenance and Repair: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, adjust, repair, or replace the components of the automotive fuel system, according to manufacturer's specifications and to meet minimum industry performance standards.
Block 6.0 (None/220 HRS)	Steering and Front End Maintenance and Repair: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, maintain, adjust, repair, or replace, the components of the automobile steering front end, and suspension systems; according to manufacturer's specifications and to meet minimum industry performance standards.
Block 7.0 (165 HRS/165 HRS)	Drive Train with Manual Transmission Maintenance and Repair: To provide the learner with the required occupational skills and repated technical information for qualification to perform inspections, adjust, service, repair or replace the components of the automotive drive train with a manual transmission; according to manufacturer's specifications and to meet minimum industry performance standards.
Block 8.0 (220 HRS/176 HRS)	Automotive Engine - Maintenance, Repair, and Overhaul: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, maintain, repair, replace, and overhaul the automotive gasoline engine (less the electrical and fuel systems); according to the manufacturer's specifications and to meet minimum industry performance standards.
Block 9.0 (None/146 HRS)	Automobile Air Conditioner Maintenance and Repair: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, service, maintain, repair or replace components of the automobile air conditioner system; according to manufacturer's specifications and to meet minimum industry performance standards. (Note: Instruction for Block 3.0 - Automotive Heater should be integrated into instruction for this block, if Block 9.0 is taught.)

Block 10.0 (None/165 HRS)	Automatic Transmissions Maintenance and Repair: To provide the learner with the required occupational skills and related technical information for qualification to perform inspections, service, maintain, adjust, repair or replace the automotive automatic transmission; according to manufacturer's specifications and to meet minimum industry performance standards.
Block 11.0 (125 HRS/231 HRS)	Automotive Electrical Systems Maintenance and Repair: High Schools Only: To provide the learner with the required occupational skills and related technical information for qualification to inspect, maintain, repair, or replace only the automotive engine electrical system, the battery, and replace bulbs and fuses of the light system. (This portion of instruction in this block is conducted primarily to provide the learner with full qualification to perform the required tasks in Block 8.0.) The learner is expected to meet the manufacturer's specifications and meet minimum industry performance standards for the limited instructional objective. CC/TI: To provide the learner with the required occupational skills and related technical information for qualification to inspect, maintain, repair, or replace all components of the automotive electrical system; according to the manufacturer's specifications and to meet minimum industry performance standards.
Block 12.0 (None/99 HRS)	Automotive Servicing: To provide the learner with the opportunity to apply previous instruction to a full range of experiences in inspecting, testing, adjusting, repairing, and replacing components in the process of "Trouble Shooting" automotive systems in a simulation of actual automotive shop situations.
Block 13.0 (None/429 HRS) (Optional)	Automotive Mechanic Cooperative Training: To provide the learner with the opportunity to apply the skills and related technical information gained from instruction received and to gain further practical experience in inspecting, testing, repairing, adjusting, and replacing automotive components while working in a commercial automotive repair shop, under the supervision of a qualified automotive repair supervisor.
Block 14.0 (None/55 HRS)	Emissions Control: To provide the learner with the information regarding air pollution, factors involved in and contributing to automotive emissions; types and operation of common emissions control by U.S. automobile makers, plus the information and skills required to inspect, service, repair or replace the six most common emissions control systems.

INSTRUCTIONAL OBJECTIVES OF TOTAL AUTOMOTIVE MECHANICS PROGRAM:

High Schools:

To provide the learner with the instruction and opportunity for practical application necessary to acquire the occupational skills and related technical information to meet minimum industry performance standards in performance of:

1) Identification of shop safety hazards, practicing shop safety requirements, shop first aid; identifying, stating purpose, and demonstrating how to use and maintain common shop tools, equipment and machinery; identifying, stating purpose and application of Standard Shop Operating Procedures. Identification and use of automotive fasteners.
2) Identification and stating the purpose and operation of the major assemblies and their components and demonstration of operator maintenance of the modern gasoline fueled automobile.
3) Listing the vocational opportunities in the automotive maintenance field, practicing interpersonal relationships with the employer, fellow workers, and the customer.
4) Doing oil changes, vehicle lubrication, tire replacement and repair, and vehicle winterization.
5) Inspection, maintenance, removal and replacement of automotive cooling system components.
6) Inspection, service, maintenance, removal and replacement of automotive heater components, if automotive air conditioner is not taught.
7) Inspection, adjustment, repair, and replacement of brake systems.
8) Inspection, adjustment, replacement or repair of automotive fuel systems and components.
9) Inspection, adjustment, service, replacement or repair of automotive drive train with manual transmission.
10) Inspection, maintenance, repair and replacement or overhaul of the automobile gasoline engine, to include the engine electrical system.

CC/TI:

One Year Program - Includes all instruction, same as above.
Two Year Program - Same as the high schools, as shown above, plus performance of:

1) Inspection, service, maintenance and repair, or replacement of components of the automotive air conditioning system, to include the automotive heater.
2) Inspection, service, adjustment, maintenance and repair, or replacement of components of the automatic transmission.
3) Inspection, maintenance and repair, or replacement of components of the automotive electrical system.
4) Practical application of completed instruction in a simulated automotive maintenance shop environment.
5) Practical application of all completed instruction in a commercial automotive maintenance shop under the conditions of a cooperative training program, to gain experience in the inspection, servicing, maintenance, and repair, or replacement of automotive operational components (Optional).
6) Inspection, service, maintenance and repair of automotive emissions control systems.

JOB QUALIFICATION OR SKILLS GAINED:

This program of instruction has the capability to provide the successful learner with a succession of progressively higher skills job qualifications, until the program is completed and the learner has reached the instructional objectives job qualifications, ie: he has successfully demonstrated ability to perform the task requirements and meet industry standards of performance for each of the blocks of automotive instruction. Successful completion of all blocks of instruction provides the learner with the ability to meet initial entry task performance standards for an Automotive Technician. With the addition of at least one year of successful work experience in a recognized automotive maintenance shop, the individual is then considered to have the qualifications of a Master Automotive Technician and should be capable of attaining such a rating by taking the tests given in the "Mechanic Testing and Certification Program" conducted by the National Institute for Automotive Service Excellence.

Those learners who complete less than the full program of instruction successfully can obtain the following job qualifications, if they successfully complete the required demonstrated performance evaluation, meeting minimum industry performance standards and have 1 to 3 months valid, like job experience: Blocks 0.0, 1.0, and 2.0 - Service Station Specialist; Blocks 0.0 and at least 4.0 - Automotive Brake Technician; Blocks 0.0 and 5.0 - Automotive Fuel System Maintenance and Repair Specialist; Blocks 0.0 and 7.0 - Manual Transmission and Rear Axle Technician; Blocks 0.0 and 6.0 - Automotive Front End Technician; Blocks 0.0, 1.0, 2.0, 5.0, 8.0, and the ignition and charging system portion of Block 11.0 - Automotive Engine Repair Technician; Blocks 0.0, 3.0, and 9.0 - Automotive Heating and Air Conditioning Technician; Blocks 0.0 and 7.0, and 10.0 - Automatic Transmission Technician (Light Repair); and Blocks 0.0 and 11.0 - Automotive Electrical Systems Technician. It is of course possible for an individual to be qualified as a technician in several different areas, but not complete the entire program of instruction. Under such circumstances, the individual would be certified for only those blocks of instruction successfully completed and evaluated and could not be considered as a fully qualified Automotive Mechanic. Should the individual concerned be interested in obtaining nationally recognized ratings in those specialties identified as technicians, at least one year of successful experience in a recognized automotive maintenance shop, plus three years of high school or two years of technical institute automotive program instruction is required; followed by successful completion of one or more of the certification tests conducted annually by the National Institute for Automotive Service Excellence.

PREREQUISITES:

See each instructional guide block cover page.

PERFORMANCE EVALUATION:

Test items are competency based (outlines, less the necessary detail or data for problem solving) for use in task and for end of course performance evaluation for job or advanced instruction qualification. Test items are provided for each instructional block.

EQUIPMENT:

See general equipment list attached to last block of program. Special tools and equipment requirements peculiar to a specific block of instruction are listed on the last page of that block.

Academic Subject Courses Required in Automotive Mechanics Program Curriculum

HIGH SCHOOLS

SUBJECT	UNITS
English I, II, III, IV	4
General Math, Algebra /Preparatory General Math or Algebra I	1
Physical Science	1
Biology	1
Industrial Practice	1
Health and P.E.	1
U. S. Studies	1
Electives	3 or 4*
Academic Total	
Automotive Total	5 or 6*
Curriculum Total	18 Units

Total varies with each school because of the variations in total automotive mechanics instructional hours available at each high school.

SUGGESTED CURRICULUM
AUTOMOTIVE MECHANIC
COMMUNITY COLLEGE/TECHNICAL INSTITUTE

One-Year Program (First Four Quarters of Two-Year Program)

Academic Subjects		Instructional Contact Hours
MAT 1100	Vocational Math	33
ENG 1101	Reading Improvement	33
GUI 1101	College Orientation	11
ENG 1102	Communications Skills	33
PHY 1101	Applied Science	55
PSY 1101	Human Relations	33
BUS 1103	Small Business Operations	33
	Total Academic Hours	231
	Total Automotive Hours	1075*
	Grand Total One-Year	1306

* There will be limited variations to this number.

Optional: Automotive Cooperative Training - AUT 1200 - if employed may follow fourth quarter for two-year program students - 449 hours.

Two-Year Program (Includes all Items Taught in One-Year Program)

Automotive Subjects		575 Hours **
Academic Subjects	(MAT 1103 - Automotive Math)	33 Hours
	Total Hours 2nd Year	608
	Grand Total Two-Year Program (Less Cooperative Training)	1914
	Grand Total Two-Year Program (With Cooperative Training)	2363

** There may be upward variations to this number.

ARTICULATION RESEARCH PROJECT
SIGNATORIES TO LOCAL AREA OCCUPATIONAL EDUCATION CURRICULUM ARTICULATION AGREEMENTS

The following listed local area public school system and community college/technical institute administrators have agreed to articulate their Automotive Mechanics Program of instruction. Such agreements involve the employment of this document as an instructional objectives guide. High school students who successfully complete recognized articulated portions of this program and are evaluated as job qualified in work completed will be given appropriate credit for such work by the local area community college/technical institute.

Cumberland Area:

Howard E. Boudreau	President	Fayetteville Technical Institute Fayetteville, North Carolina
C. Wayne Collier	Superintendent	Cumberland County Public Schools Fayetteville, North Carolina
R. Max Abbot	Superintendent	Fayetteville City Schools Fayetteville, North Carolina

Duplin Area:

Carl D. Price	President	James Sprunt Institute Kenansville, North Carolina
Charles H. Yelverton	Superintendent	Duplin County Public Schools Kenansville, North Carolina

Person Area:

W. S. Rogers	Superintendent	Person County Public Schools Roxboro, North Carolina
E. W. Cox	President	Piedmont Technical Institute Roxboro, North Carolina

Wayne Area:

J. K. Wooten	Superintendent	Wayne County Schools Goldsboro, North Carolina
W. R. Johnson	Superintendent	Goldsboro City Schools Goldsboro, North Carolina
C. E. Erwin, Jr.	President	Wayne Community College Goldsboro, North Carolina

THE ARTICULATION RESEARCH PROJECT

Background: The Articulation Research Project was initiated on September 1, 1974 as a State Board of Education approved joint effort by the President of James Sprunt Institute and the Superintendent of the Duplin County Public Schools. It was and is supported by the North Carolina Occupational Research Unit, State Department of Public Education with funding provided jointly by the State Departments of Public Instruction and Community Colleges.

The occupational program instructors of James Sprunt Institute and the teachers from the Duplin County High Schools, assisted by appropriate occupational advisors, acting as a joint area committee were responsible for the development of the instructional material content of the initial articulated instructional objectives guide for this program. That guide was in turn updated, revised, and refined by a state level committee to provide a pilot model for a state articulated instructional objectives guide for this program. This guide will be used by all secondary and post-secondary institutions and teachers who have entered into local area articulation agreements for this program.

The state level committee that developed the revisions and refinements to the Duplin Area Committee produced guide consisted of representatives from each local area joint advisory and program committee for the occupation concerned that is operational in the areas of the state that have entered into local area articulation agreements. Each local area sent both secondary and post-secondary occupational teachers/instructors as representatives for each articulated program, plus at least one advisor for each program, to participate as the state advisory and program committee. Where possible, a state occupational education staff member from both the Department of Public Instruction and the Department of Community Colleges participated in the role of acting executive secretary for each joint state advisory and program committee. This committee acting as a whole performed the actions cited above. The joint state advisory and program committee members participating from the local areas and state staff personnel are listed below.

NORTH CAROLINA JOINT AUTOMOTIVE MECHANICS ADVISORY AND PROGRAM COMMITTEE

Ted Rollins	T & I Consultant	N. C. Department of Public Instruction Raleigh, NC
Lester Anderson	Advisor, Duplin Area	Warsaw Motor Co. Warsaw, NC
Huett Braxton	Advisor, Duplin Area	O'Neal Motors, Inc. Raleigh, NC
Charles B. Massey	Advisor, Wayne Area	Brack-Wilson Ford Smithfield, NC
Jesse W. Barrett	Person Area	Person County Schools Roxboro, NC

John L. Cade, Jr.	Cumberland Area	Cumberland County Schools Bunn Level, NC
Richard A. Fry	Duplin Area	James Sprunt Institute Kenansville, NC
Andrew Krainiak	Cumberland Area	Fayetteville City Schools Fayetteville, NC
Ed R. Musselwhite	Cumberland Area	Cumberland County Schools St. Pauls, NC
James C. Newbold	Person Area	Piedmont Technical Institute Roxboro, NC
Bobby W. Perkins	Cumberland Area	Fayetteville Technical Inst. Fayetteville, NC
Elmer Rackley	Wayne Area	Wayne County Schools Pikeville, NC
Luby D. Worley	Wayne Area	Wayne Community College Goldsboro, NC

Credits:

Task Listing — Prepared with the assistance of Automotive Advisors

Instructional Objectives Guide Content - Prepared by the Duplin Area Automotive Instructors, updated and revised by the Joint Advisory and Program Committee Instructors.

Editor	Carlyle P. Woelfer, Ed.D.	Project Director
Typist	Carla J. Gaiser	James Sprunt Institute
Printing	Offset Room	James Sprunt Institute

Block 14.0 - Emissions Control - Developed based upon Fayetteville Technical Institute material with input and review from advisors:

Lester Anderson	Duplin Area Advisor	Warsaw Motor Co. Warsaw, NC
Victor Finocchi	Duplin Area Advisor	Royal Dodge Fayetteville, NC

DEVELOPMENTAL PROCEDURES
FOR THE
AUTOMOTIVE MECHANICS INSTRUCTIONAL OBJECTIVES GUIDE

To ensure that the instructional objectives were valid with industry requirements, the automotive advisors were asked to identify in order of complexity the job tasks which an automotive mechanic must be qualified to do in each of the major assembly or operational areas of the modern automobile. This grouping has been identified as blocks. In most cases a block of instruction is identified with a specific specialty as pertains to the automobile. The task listings of the advisors were in turn consolidated into a standardized task listing representing the committee agreed upon tasks, titles, and complexity sequences. At the same time, the various tasks were also identified by frequency of performance and the job skill level of the individual normally required to perform the task. The standardized task listing follows this narrative.

With the information provided by the task listing, the automotive instructors then developed the instructional objectives for the program by converting each task into an instructional objective. This objective was then reduced to skills (process objectives), what the learner must be taught how to do, and the related technical information, which is the informational type knowledge that is required for the worker to be able to perform the task at hand. The instructors also estimated the number of instructional contact hours required for the average student in a regular class to achieve the instructional objective, assuming that the required resources are available.

The performance standards listed for each instructional objective are based upon industry publications, instructor occupational experience, and advisor recommendations. These standards are the minimum industry performance standards that must be met by the learner for initial job qualification in performance of the task specified.

To ensure that the standards and the technical content of the instructional guides are fully valid, accurate, and adequate, the automotive advisors are then asked to review the guide and comment on possible errors in fact and suggested improvements. The total committee will then meet to discuss proposed changes and an errata sheet will then be published.

The instructors also prepared standardized test items for each block of instruction in the program. These test items will be used in evaluation of performance of the learner for each block of instruction, at both levels of education. These items relate directly to the instructional objectives. Every effort is being made to ensure that the test items are valid and reliable, in the determination of the learner's ability to meet performance standards for occupational qualification. The emphasis in testing will be upon performance, but written related information test items and the instructor's evaluation of the learner, based upon classroom performance, are also included for measurement of occupational qaalification. The test items in most cases are outline in nature and require certain specific data prior to use to be complete.

Following the last block of instructional objectives guides is a set of Student Vocational Skills Records which are for the use of the instructor in recording learner progress and performance. The learner can be given a folding, pocket size, instructional objectives and performance card with the same information as that on the instructor's records, to permit the student to keep track of his progress and to determine future requirements.

The Instructional Objectives Guide is intended for use by all instructors involved in articulation, both high school and CC/TI, to guide the subject matter content of their programs. This is to ensure that all learners will get the same minimum instructional content and emphasis for a specific block of instruction and that the same performance standards be applied in determining whether or not a learner is occupationally qualified to perform the tasks required.

ARTICULATION RESEARCH PROJECT

Purpose of Instructional Objectives Guides

Articulated instructional objectives guides are expected to serve the following purposes:

1. Serve as the primary vehicle for the articulation of subject matter in like occupational programs between the high schools and the technical institutes/community colleges, through use by instructors at both levels.

2. Provide a listing of the minimum tasks that a worker is expected to perform in the conduct of a specific level job in the occupation of concern.

3. Identify the primary detailed instructional objectives which are based upon the task listing. The tasks are listed in the sequence of complexity, with the least complex tasks being listed first, except where a task must be performed as a prerequisite to performance of another. The sequence of task listing is expected to influence the sequence of instruction. Task listings are internally grouped as duties or blocks of instruction.

4. Identify the skills (Process Objectives) and related technical information which must be taught and learned to accomplish the instructional objective. These represent the minimum skills and related information required for adequate occupational proficiency in task performance.

5. Designate the instructional contact hours considered necessary to conduct the required instruction. This is an estimate by the instructors of the area program and advisory committee as to the time required to teach the average learner to perform the task and, in most cases, to provide the opportunity to the learner to perform more than one practical work exercise to gain occupational proficiency. This time estimate is based upon the assumption that the instructor will have available the essential equipment, facilities, and instructional aids required to conduct the instruction, with the class size limited to the number of students shown on the equipment list.

6. Identify the performance standards to be met for occupational proficiency in the task. Performance standards used are those considered to be minimum business or industry standards such as are found in the professional standards guides issued by occupational associations of the business or industry. The standards are those which the learner must be capable of meeting upon completion of his program or course of instruction, if he is to be considered as qualified to perform at a specific job level or a specific job, in the occupation of the program. The ability to meet the listed standards of performance will also be considered as qualification for advanced instruction in that occupational program.

7. Provide a guide in the conduct of sequential occupational competency instruction by duties or blocks, resulting in qualification by the learner to perform limited skill specialist jobs of progressively higher skills until the program objective is reached, ie: file clerk to executive secretary; brake technician to automotive mechanic, etc. Unless it is essential that a learner be given

instruction in a specific block or duty as a prerequisite for instruction in a subsequent block, the complexity sequence established should be followed. As the learner becomes proficient in the performance of tasks in successive more complex blocks, he gains more marketable competencies that are indentifiable as the lower level job qualifications of a specialist, while working towards higher skills. This provides an opportunity for even the slow student to eventually gain sufficient skills to perform adequately as a specialist at some level in the occupation, despite the fact he may lack the ability to complete the program. The same holds true for the learner who has progressed satisfactorily through "several" initial blocks of occupational instruction (depending upon the program) and then for some valid reason is unable to complete the program or must leave school. Such flexibility in a program of instruction permits the maximum number of students to benefit from the instruction. Standardized sequences of instructional block presentation also ensure that lateral articulation can be practiced between the high schools of a local area and simplifies vertical articulation of subject matter with the local post-secondary institution.

8. Provides a listing of equipment required to conduct the program of instruction. Equipment listed is that considered to be the type and quantity essential for the conduct of instruction leading to job qualification in the occupation, with the class limited to the size stated. If class size exceeds the number for which the equipment is provided, instruction will normally be degraded or take longer. In some cases, expensive items of equipment, that have limited use, can be shared between schools, if adequate transportation and scheduling support is provided by the county school office. In some instances it may be possible to delay teaching of several tasks involving special equipment and then arrange to take the class to the location of such equipment for instruction.

9. Provide a list of standardized performance test items to be used in the determination of occupational proficiency. The test items attached to each block of instruction are for the most part "outline type" test items, showing the test objective, since they lack the specific detailed information which must be provided for use as a performance evaluation vehicle. This would be provided at the time of use. These test items are designed to be valid and reliable means of evaluation of proficiency in the performance of a specific task. Performance standards are provided with each test item. The test items listed cannot be easily compromised, as long as the specifics are not provided, and could be used as study guides.

10. It is recognized that there may be unlisted tasks that some employers may require the worker to do in the occupation, when in their employment. The tasks listed are the minimum requirements for qualification for the job under average circumstances on a regional basis. The tasks are not limited to a specific area employment situation or employer. Instructors may teach more skills and related technical information than is shown in the guides. Such information should be limited to the students who have completed the requirements for the tasks concerned in the instructional objectives guide. Normally the addition of tasks to those in the guide should be based upon local committee agreed area requirements and be taught by all schools teaching the block of instruction.

11. Up-dating and correction of items in the instructional objectives guides: Teachers/instructors are encouraged to view the instructional objectives guides critically in an effort to ensure that the contents are valid and current with

business and industry requirements. Recommendations for change or correction should be submitted to the executive secretary of the committee, who should then assemble and present them to the advisory and program committee as a whole, for review and possible adoption.

12. Instructional Blocks (Duties): Under normal circumstances the instructor/teacher should not plan to conduct instruction in a given articulated block of instruction unless the capability exists to conduct all of the instruction to meet the instructional objectives, with the result that the successful learner is occupationally qualified to perform the tasks identified with the block. This of course means that in several cases the high schools will lack the capability to conduct a full program of instruction owing to lack of resources or instructor time. In such situations, the successful learner, on leaving high school and certified as qualified as a limited skill specialist or lower level job in the occupation can seek employment at that level or he can go on to the local post-secondary institution and complete the program. The front cover sheet for each block of instruction shows the total instructional contact time allocated for high school instruction and for the post-secondary institution. In most cases, the high schools are allocated more time for the same instructional block owing to the usually large classes, limited physical resources, often less learner maturity, at times less laboratory time, and more administrative interruptions. However, there may be instances where the high schools are allocated less time in a given instructional block. This is caused by the fact that the post-secondary institution covers the block (Automotive Electrical Systems) in its entirety, for occupational qualification, whereas the high schools will be expected to cover only that part related as a prerequisite or parallel to another block. In this case, conduct of a portion of the block instructional objectives is appropriate. The overall philosophy to be applied in occupational programs is that it is better to ensure that the learner is fully qualified to perform all of the tasks in a limited group of blocks or modules in an occupation and qualify as a specialist, than to be only familiar with a large number of tasks and occupationally qualified to perform none of them.

13. Most occupational programs will contain certain basic blocks of instruction without which a student would not be considered occupationally qualified at any level. Such blocks are normally identified as blocks 0.0 to 1.0 and on occasions blocks 2.0 and 2.5. Such blocks usually are base blocks and should be taught early or first in the program sequence.

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ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: Introduction to Automotive Technology 0.0

SUB-BLOCK OR DIVISION: 0.0 SHOP OPERATIONS AND SAFETY

TASK	(In Order of Complexity)	MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
0.11	Practice shop safety. (Fire, cleanliness, orderly work area, lifting, acid, good ventilation, etc.)			X		X		
0.12	Follow required procedures for shop hazard emergencies. (Burns, electrical shock, injury, poison, carbon monoxide, fumes, etc.)			X		X		
0.13	Identify, learn how to use properly, and maintain common hand tools and measuring devices.			X		X		
0.14	Identify and learn how to use properly items of common shop equipment. (Jacks, lifts, air compressors, etc.)			X		X		
0.15	Identify and learn how to use properly items of common use shop machinery. (Grinders, drills, etc.)			X		X		
0.16	Be familiar with and able to apply correctly Standard Shop Operating Procedures. (Flat Rate Manual, Job Orders, Parts Requisitions, Common Shop Terminology (jargon)).			X		X		
0.17	Identify and learn use(s) of standard automotive fasteners.			X		X		

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

SUB-BLOCK OR DIVISION: 0.20 The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation and Driver Maintenance.

TASK	MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
0.201 Lubrication and Tires: Know types, purpose, application, and operator maintenance.			X		X		
0.202 Cooling System: Know purpose, operation, major parts, and operator maintenance.			X		X		
0.203 Braking System: Know purpose, operation, major parts, and operator maintenance.			X		X		
0.204 Fuel System: Know purpose, types of fuel, system operations, major parts, and operator maintenance.			X		X		
0.205 Steering System and Front End: Know purpose, operations, major parts, and operator maintenance.			X		X		
0.206 Power Train and Manual Transmission: Know purpose, operations, major parts, and operator maintenance.			X		X		
0.207 Engine: Know purpose, operations, major parts, and operator maintenance.			X		X		
0.208 Automobile Heaters and Air Conditioners: Know purpose, operation, major parts, and operator maintenance.			X		X		
0.209 Automatic Transmission: Know purpose, operation, major parts, and operator maintenance.			X		X		

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

SUB-BLOCK OR DIVISION: 0.20 (Con't.)

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
0.210	Automotive Electrical Systems: Purpose, operations, major parts, and operator maintenance.			X		X		
0.211	Emissions Control: Learn Purpose, operation, major components, and operator maintenance.		X			X		
SUB-BLOCK OR DIVISION: 0.30	The Automotive Technician							
0.31	Know Opportunities and job availability for the Automotive Technician.			X		X		
0.32	Know how to get a job, hold a job, and earn advancement. (Good references, first impressions, reliability, quality performance, etc.)			X		X		
0.33	Know how to meet people and to be accepted by fellow employees.			X		X		
0.34	Know the technician's responsibilities toward his employer, the customer, and his craft. (The work ethic, honesty, legal concerns, public relations, the shop image, etc)			X		X		

NOTE: Block 0.0 contains the essential General Information and Vocational Guidance for Automotive Program. Time permitting, "History of the Automobile" may be added.

3.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: LUBRICATION AND VEHICLE OPERATING MAINTENANCE 1.0

TASK (In Order of Complexity)		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
1.01	Change oil and filters.				X	X	X	X
1.02	Lubricate vehicles and equipment.			X		X	X	X
1.03	Remove, repair or replace tires, maintain equipment.			X		X	X	X
1.04	Winterize vehicles.			X		X	X	X

BLOCK OR DIVISION: COOLING SYSTEM MAINTENANCE AND REPAIR 2.0

TASK (In Order of Complexity)		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
2.01	Check coolant freezing point.			X		X	X	X
2.02	Inspect and replace water hoses.			X		X	X	X
2.03	Pressurize and inspect coolant system.			X		X	X	X
2.04	Test and replace thermostat.			X		X	X	X
2.05	Check overflow tank and accessories.			X		X	X	X
2.06	Remove and reinstall radiators.	X				X	X	X
2.07	Chemically clean and flush cooling system.	X				X	X	X
2.08	Replace water pump.			X			X	X
2.09	Replace freeze plugs.	X					X	X
2.10	Inspect, replace and adjust belts.			X		X	X	X
2.11	Inspect, remove and replace fan clutch.		X			X	X	X

4.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
BLOCK OR DIVISION:	AUTOMOBILE HEATER MAINTENANCE AND REPAIR 3.0 (Performed in conjunction with Block 9.0)							
3.01	Inspect and replace defroster hose.	X				X	X	X
3.02	Service heater control components.		X				X	X
3.03	Replace heater water control core.	X					X	X
3.04	Service or replace circulating heaters.	X					X	X
3.05	Diagnose heating system malfunctions.		X				X	X
BLOCK OR DIVISION:	BRAKING SYSTEM MAINTENANCE AND REPAIR 4.0							
4.01	Adjust brakes.				X	X		
4.02	Adjust hand brake linkage.				X	X		
4.031	Free up parking brake cables.				X	X		
4.032	Replace hand brake linkage.				X	X		
4.041	Bleed brakes.				X	X		
4.042	Service brake warning system.		X				X	
4.043	Service brake metering valve.		X				X	
4.05	Inspect, repair or replace self-adjusters.				X		X	
4.06	Replace brake hoses and lines.				X		X	
4.071	Inspect and replace brake pads (disc brakes).				X		X	

5.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: 4.0 (Con't)

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
4.072	Inspect and replace brake shoes.				X		X	
4.081	Inspect and turn rotor if necessary (disc brakes).	X						X
4.082	Inspect and turn brake drums.		X					X
4.083	Radius grind brake shoes.		X				X	
4.09	Repair or replace wheel cylinder.				X		X	
4.10	Repair or replace master cylinder.				X		X	
4.11	Repair or replace hydraulic power cylinders and valves.				X		X	
4.12	Perform operational brake inspections.				X			X
BLOCK OR DIVISION:	FUEL SYSTEM MAINTENANCE AND REPAIR 5.0							
5.01	Inspect, service, or replace carburetor air cleaner.				X	X		
5.02	Clean or replace fuel filter units.				X	X		
5.03	Remove, service, or replace fuel pumps or fuel lines and hoses.		X				X	
5.04	Install carburetors.				X		X	
5.05	Inspect and measure fuel flow and pressure of system.	X					X	

6.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: 5.0 (Con't)

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
5.06	Adjust carburetor.				X		X	
5.07	Inspect, clean and adjust choke unit (automatic and manual).				X		X	
5.08	Inspect, service, or replace gas tank, cap and sending unit.	X					X	
5.09	Repair or service carburetors.			X			X	
5.10	Analyze fuel injection problems by means of electrical diagnostic equipment.				X			X
BLOCK OR DIVISION:	STEERING AND FRONT END MAINTENANCE AND REPAIR 6.0							
6.01	Lubricate the front and rear suspension.				X	X		
6.02	Replace belts and set tension.			X		X	X	X
6.03	Adjust worm and sector in steering box.			X			X	X
6.04	Repair or replace manual steering components.		X				X	X
6.05	Repair, rebuild, or replace power steering components.		X				X	X
6.06	Repair or replace tilt and telescoping and collapsible mast jackets.	X					X	X
6.07	Perform visual inspections of suspension systems.				X		X	
6.08	Replace shock absorbers and mounting.			X		X		

7.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: 6.0 (Con't)

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
6.09	Replace front wheel bearings grease seal.			X		X		
6.10	Repair or replace rear suspension system.			X			X	
6.110	Inspect and repair front suspension systems.			X				X
6.111	Replace pivot points on steering linkage.	X					X	X
6.112	Rebush king pins or link pins.			X			X	
6.113	Replace ball joints.			X			X	
6.114	Replace front suspension control arms and bushings.			X			X	
6.115	Adjust or replace torsion and trunion bars.		X				X	
6.12	Balance wheels and tires.			X			X	
6.131	Inspect, adjust and repack front wheel bearing.			X			X	
6.132	Inspect and replace steering spindles.		X				X	X
6.14	Inspect and align front end.			X				X
6.15	Inspect and align rear end.		X					X

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: DRIVE TRAIN AND MANUAL TRANSMISSION 7.0

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
7.01	Lubricate U-joints.		X			X	X	X
7.02	Lubricate speedometer cable drive gear and housing.		X			X	X	X
7.03	Repair or replace slip-joints or U-joints.			X			X	X
7.04	Replace drive-line seals.		X				X	X
7.05	Test and replace out-of-round drive shaft.		X				X	X
7.06	Inspect drive shafts, U-joints and center bearing.			X				X
7.07	Replace manual transmission gaskets and seals (in-car repairs).		X				X	X
7.08	Replace pilot bearings.	X					X	X
7.09	Replace throwout bearings.	X					X	X
7.10	Replace transmission mounts.		X				X	
7.11	Adjust mechanical-type clutch.			X			X	
7.12	Adjust external shift linkage on manual transmissions.			X			X	
7.13	Inspect shifting.			X			X	
7.14	Perform operational manual transmission inspections.			X				X

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: 7.0 (con't)

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
7.15	Replace mechanical type clutch.				X		X	
7.16	Replace a manual transmission	X					X	
7.17	Rebuild manual transmission (major repairs).	X						X
7.18	Replace rear-axle shaft, bearings and seal.		X				X	X
7.19	Replace pinion seal.		X				X	X
7.20	Replace differentials.				X		X	X
7.21	Overhaul differential.		X					X
7.22	Perform operational inspections of differentials.		X					X
7.23	Road test inspections of differentials.		X					X
BLOCK OR DIVISION:	ENGINE-MAINTENANCE, REPAIR, AND OVERHAUL 8.0							
8.01	Clean engines.		X			X		
8.02	Inspect exhaust systems.			X			X	
8.03	Inspect or remove and replace exhaust manifolds.	X					X	
8.04	Remove and replace engine mounts.		X			X		
8.051	Perform operational inspections of positive crankcase ventilation systems.		X				X	
8.052	Repair or service crankcase ventilation systems.		X				X	

10.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: 8.0 (Con't)

TASK		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
8.061	Run compression test.			X			X	
8.062	Perform cylinder leakage test.			X				X
8.063	Perform cylinder balance test.			X				X
8.064	Diagnose valve train and head malfunctions.		X					X
8.07	Clean engine parts and make visual check for condition.		X				X	
8.08	Remove and replace pan and valve covers.		X				X	
8.09	Perform operational inspections of engine lubrication systems.			X			X	
8.10	Remove and replace gaskets and seals.			X			X	
8.11	Remove and replace head gaskets.			X			X	
8.12	Inspect head for warp.		X				X	
8.131	Adjust valves.		X				X	
8.132	Remove and replace valves.		X				X	
8.14	Grind Valves.		X				X	
8.15	Resurface valve seats.		X				X	
8.16	Remove and replace valve lifters.		X				X	
8.17	Remove and replace valve guides.	X		(Job for Machine Shop)				x

11.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

BLOCK OR DIVISION: 8.0 (Con't)

TASK		Frequency that average worker will be required to perform the task.				Level of difficulty: normally performed by skill level or levels checked.		
		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
8.18	Remove and replace valve seats.	X	(Job for Machine Shop)					X
8.19	Machine valve guides for special seals.	X					X	
8.20	Remove and replace oil pumps.	X					X	
8.21	Repair oil pumps.	X					X	
8.22	Remove and replace timing gears and chains.		X				X	
8.23	Remove and replace flywheel.	X					X	
8.24	Remove and replace flywheel ring gears.	X					X	
8.25	Remove and replace engines from vehicles.		X				X	
8.26	Remove and replace connecting rods and bearings.		X				X	
8.27	Remove and replace pistons.		X				X	
8.28	Remove and replace rings on pistons.		X				X	
8.29	Remove and replace crankshaft and bearings.		X					X
8.30	Inspect crankshaft and connecting rod assembly using micrometers and other equipment.		X					X
8.31	Inspect and correct bearing fit.		X					X
8.32	Remove and replace camshaft.		X					X
8.33	Remove and replace camshaft bearings.		X					X

12.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

BLOCK OR DIVISION: AUTOMOBILE HEATER AIR CONDITIONER MAINTENANCE AND REPAIR 9.0
(NOTE: Block 3.0 Tasks performed in conjunction with Block 9.0)

TASK		Frequency that average worker will be required to perform the task.				Level of difficulty: normally performed by skill level or levels checked.		
		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
9.001	Service heater and air conditioner control components.		X			X	X	
9.01	Discharge system.			X		X		
9.02	Remove and replace air conditioner fan motor.	X						X
9.03	Remove and replace dryer in air conditioning unit.	X						X
9.04	Service air conditioner control cables and switches.		X					X
9.05	Remove and replace freon control valve in air conditioning unit.		X					X
9.06	Remove and replace expansion valve in air conditioning unit.	X						X
9.07	Remove and replace compressor seals.		X					X
9.08	Remove and replace condenser in air conditioning unit.	X						X
9.09	Remove and replace evaporator in air conditioning unit.	X						X
9.10	Repair or remove and replace air conditioning compressor.	X						X
9.11	Install air conditioners in vehicles.	X						X

13.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: 9.0 (Con't)

TASK	MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
9.12 Pressure test, performance test, and leak test the system.			X				X
9.13 Diagnose heating and air conditioning malfunctions.			X				X
9.14 Repair automatic a/c and heater systems vacuum and electrical circuits.		X					X
BLOCK OR DIVISION: AUTOMATIC TRANSMISSIONS MAINTENANCE AND REPAIR 10.0							
10.011 Diagnose transmission problems.		X			X	X	
10.012 Adjust floor shift linkage.		X				X	
10.013 Adjust linkage from steering column to automatic transmission.			X			X	X
10.014 Adjust linkage from engine to automatic transmission.			X			X	X
10.02 Clean and visually inspect transmission.			X			X	X
10.03 Replace or adjust modulators.		X				X	X
10.04 Service filter and check transmission cooling system.			X			X	X
10.05 Replace or adjust neutral switch.	X					X	X

BLOCK OR DIVISION: AUTOMATIC TRANSMISSIONS MAINTENANCE AND REPAIR 10.0 (cont'd.)

TASK:		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTERMEDIATE	HIGHEST
10.06	Make external adjustment of bands on automatic transmissions.		x				x	x
10.07	Remove and install automatic transmission.		x				x	x
10.08	Remove and replace external seals, gaskets, and lines on automatic transmissions.		x				x	x
10.09	Inspect and remove and replace converter.		x				x	x
10.10	Inspect and repair front pump and components.	x						x
10.11	Make internal repairs and adjustments on automatic transmissions.		x					x
10.12	Perform operational automatic transmission inspections.		x					x

BLOCK OR DIVISION: AUTOMOTIVE ELECTRICAL SYSTEMS MAINTENANCE AND REPAIR 11.0

TASK:		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTERMEDIATE	HIGHEST
11.01	Clean, gap, and test spark plugs.			x		x		
11.02	Replace light bulbs.			x		x		
11.03	Replace flasher units.			x		x		

BLOCK OR DIVISION: AUTOMOTIVE ELECTRICAL SYSTEMS MAINTENANCE AND REPAIR 11.0
(cont'd.)

TASK:	MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTERMEDIATE	HIGHEST
11.04 Test, service or replace batteries, cables, and battery boxes.			x		x		
11.05 Perform operational inspections of lighting and electrical systems.			x			x	
11.06 Remove and replace stop-light switch.		x			x		
11.07 Adjust headlights.			x		x		
11.08 Adjust, remove, repair, or replace back-up light switches.	x				x		
11.09 Set ignition timing.			x			x	
11.10 Remove and replace generators or alternators.		x			x		
11.11 Remove and replace starters.		x			x		
11.12 Repair starters and solenoids.		x				x	
11.13 Repair generators or alternators.		x				x	
11.14 Repair or remove and replace charging system regulators.		x				x	

BLOCK OR DIVISION: AUTOMOTIVE ELECTRICAL SYSTEMS
MAINTENANCE AND REPAIR 11.0
(cont'd.)

TASK:	MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTERMEDIATE	HIGHEST
11.15 Analyze malfunctions in the cranking system.		x				x	
11.16 Remove, repair, replace and adjust distributor.		x				x	
11.17 Remove and replace turn signal switches.		x				x	
11.18 Remove and repair windshield wiper mechanisms or controls.		x				x	
11.19 Remove and replace fuse block assembly.	x						x
11.20 Remove and replace chassis and under-hood wiring.	x						x
11.21 Test and rewire dash units.	x						x
11.22 Test and repair automatic alarm systems of safety items.	x						x
11.23 Test and repair cruise control units.	x						x
11.24 Evaluate alternator, generator and regulator output.		x					x
11.251 Analyze or adjust engine performance using engine analyzer.			x				x

17.0

BLOCK OR DIVISION: AUTOMOTIVE ELECTRICAL SYSTEMS MAINTENANCE AND REPAIR 11.0
(cont'd.)

TASK:	MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTERMEDIATE	HIGHEST
11.252 Inspect and test secondary circuit leads, plug wires, distributor cap, and rotor.			x				x
11.253 Inspect and repair ignition switch, resistor, wiring, coil, points, and condenser of the primary circuit.			x				x
11.254 Locate and repair shorts and open circuits in wiring.		x					x
11.255 Test, service, repair or replace components of electronic ignition systems.		x					x
11.26 Perform complete engine tune-up.			x				x

18.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: Emissions Control 14.0

TASK:

		MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
14.01	Know the air pollution problem.			x		x	x	x
14.02	Know factors involved in and contributing to automotive emissions.			x		x	x	x
14.03	Know types and method of operation of common emission control systems and how to identify each.			x		x	x	x
14.04	Service, repair or replace positive crankcase ventilation systems.			x				x
14.05	Service, repair or replace fuel evaporation systems.			x				x
14.06	Service, repair or replace air injection systems.			x				x
14.07	Service, repair or replace thermostatic air cleaners.			x				x
14.08	Service, repair or replace exhaust air recirculation systems.			x				x
14.09	Service, repair or replace engine modification systems.			x				x
14.10	Know impact of emission control systems on engine operations.			x		x	x	x
14.11	Know impact of engine operations on emissions control systems.			x		x	x	x

19.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS
AUTOMOTIVE MECHANICS

Frequency that average worker will be required to perform the task.

Level of difficulty: normally performed by skill level or levels checked.

BLOCK OR DIVISION: Emissions Control 14.0

TASK:	MONTHLY OR LESS	WEEKLY	DAILY	MORE OFTEN	LOWEST	INTER-MEDIATE	HIGHEST
14.035 Test, service, remove and replace catalytic converter.		x					x
14.12 Inspect, remove and replace tail pipe and/or muffler.		x			x	x	x

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Introduction to Automotive Technology (Block 0.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently a part of Auto Mechanics I and Auto Mechanics II, T & I 7391 and 7392

Department of Community Colleges -
AUT 1100 - Introduction to Auto Mechanics

INSTRUCTIONAL HOURS: High Schools - 180
CC/TI - 176

INSTRUCTIONAL OBJECTIVES:

1. To provide occupational information to the learner regarding common automotive shop hazards; shop safety practice requirements and protective devices; fire prevention practices; and how to maintain a safe and efficient work area.

2. To provide occupational information and training to the learner on emergency techniques appropriate for normal automotive maintenance shop hazards, when such hazards result in injury.

3. To provide information and training to the learner on how to identify, use and maintain common hand tools, shop equipment, and shop machinery.

4. To provide information to the learner on the knowledge and performance requirements for standard administrative procedures in an automotive maintenance shop.

5. To provide information and training to the learner on the identification of the major assemblies of the modern automobile and the primary components of these assemblies; the mechanical purpose and operation of the major assemblies as part of the total vehicle; and vehicle operator maintenance requirements and procedures.

6. To provide vocational information pertaining to the Automotive Maintenance Industry.

7. To provide occupational information regarding the interpersonal relationships and responsibilities of the automotive technician towards fellow workers, his supervisors, employers, the customer, and his craft, which will improve his chances for a successful career.

QUALIFICATION OR JOB SKILLS GAINED:

This block of instruction does not by itself provide a recognized job level qualification. It is designed to provide the learner with necessary basic skills and related technical, vocational, and general information in three foundation areas of the Automotive Technician Program of instruction. These are:

1. Shop Operations and Safety - Provides information as to the common automotive shop hazards and instruction in how to apply the necessary first aid to injuries from such hazards; how to use and maintain common automotive shop hand tools, equipment, and machinery; and the performance requirements for standard automotive shop operating procedures.

2. The Motor Vehicle - Major assembly and component identification and mechanical operation of each; plus performance of operator maintenance requirements.

3. The Automotive Technician - Vocational guidance and information regarding the automotive maintenance industry and the occupational opportunities for the automotive technician.

This block does provide the successful learner with a job qualification in the automotive service industry, as a service station specialist, when coupled with at least Block 1.0 [Lubrication and Vehicle Operating Maintenance] and Block 2.0 [Cooling System Maintenance and Repair], of the Automotive Mechanics Program. This qualification should be confirmed by evaluation of demonstrated performance and knowledge of related technical information.

PREREQUISITES: None (Desirable - High School: I.I.E. and Occupational Interest;
CC/TI: Occupational Interest and Mechanical Aptitude)

PERFORMANCE EVALUATION:

Standardized test items are to be used in evaluation of occupational qualification. The emphasis is upon demonstrated performance and knowledge of related technical information. The test items are outlines and for the most part require specific situations, data, and the automotive component concerned before use in learner evaluation. The test items are related to the specific tasks which have been designated as the instructional objectives.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program's instructional objectives guide. Special equipment requirements peculiar to a specific block of instruction are attached to the instructional objective guide block concerned.

NOTE: All instructional times shown are "suggested instructional times" and include the explanatory, demonstration, application, evaluation, and critique phases of instruction.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

Automotive Mechanics

BLOCK 0.0 - INTRODUCTION TO AUTOMOTIVE TECHNOLOGY

SUB-BLOCK NUMBER: 0.10 TITLE: Shop Operations and Safety

TASK NUMBER: 0.11 TITLE: Know and Practice Shop Safety

INSTRUCTIONAL OBJECTIVE - 0.11: To Learn Shop Safety Hazards and Required Safety Practices For Such Hazards.

SKILLS: (Process Objectives)

0.111 - State and list shop safety hazards.
0.112 - State, list, and demonstrate safety practices for each hazard cited.

RELATED TECHNICAL INFORMATION:

Required safety practices for shop hazards.

REQUIRED INSTRUCTIONAL TIME: 0.11, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can list hazards and required safety practices with 90% accuracy.

TASK NUMBER: 0.12 TITLE: Know and Apply Emergency Procedures Required By Injuries Caused by Shop Hazards.

INSTRUCTIONAL OBJECTIVE - 0.12: How to Perform Emergency Procedures Required By Shop Hazard Injuries.

SKILLS: (Process Objectives)

0.121 - First aid requirements for shop hazards.
0.122 - How to perform first aid for shop hazards.

RELATED TECHNICAL INFORMATION:

Required first aid materials. First aid manual.

REQUIRED INSTRUCTIONAL TIME: 0.12, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

Can perform the required emergency actions correctly for a given injury with 90% accuracy.

SUB-BLOCK NUMBER: 0.10 TITLE: Shop Operations and Safety (cont'd.)

TASK NUMBER: 0.13 TITLE: Identify, Learn How to Use Properly, and Maintain Common Hand Tools and Measuring Devices.

INSTRUCTIONAL OBJECTIVE - 0.13: To Identify and State Purpose of Common Automotive Hand Tools and Measuring Devices and How to Properly Use and Maintain Such Tools.

SKILLS: (Process Objectives)

0.131 - Identification of shop tools and measuring devices.
0.132 - State purpose of shop tools and measuring devices by item.
0.133 - How to use and maintain common shop tools and measuring devices.

RELATED TECHNICAL INFORMATION:

Tool care and maintenance.

SUGGESTED INSTRUCTIONAL TIME: 0.13 10 hours.

REQUIRED PERFORMANCE STANDARDS:

Identification and purpose of tool or measuring devices, 80% accuracy.
Demonstrate how to use and maintain tools and measuring devices with 85% accuracy.

TASK NUMBER: 0.14 TITLE: Identify, Learn How to Use Properly Items of Common Shop Equipment.

INSTRUCTIONAL OBJECTIVE - 0.14: To Identify, State Purpose, Demonstrate How To Use Properly Items of Common Shop Equipment.

SKILLS: (Process Objectives)

0.141 - To identify and state purpose of shop equipment.
0.142 - How to use common shop equipment.

RELATED TECHNICAL INFORMATION:

Equipment care and maintenance.

SUGGESTED INSTRUCTIONAL TIME: 0.14 2 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify and state purpose of shop equipment items, 80% accuracy.
Learner demonstrates how to use properly shop equipment items with 85% accuracy.

SUB-BLOCK NUMBER: 0.10 TITLE: Shop Operations and Safety (cont'd.)

TASK NUMBER: 0.15 TITLE: Identify, Learn How to Use Properly Items of Common Use Shop Machinery.

INSTRUCTIONAL OBJECTIVE - 0.15: To Identify, State Purpose, Demonstrate How To Use Properly Items of Common Shop Machinery.

SKILLS: (Process Objectives)

0.151 - To identify and state purpose of common shop machinery.
0.152 - How to use common shop machinery.

RELATED TECHNICAL INFORMATION:

Equipment manufacturer's instructions manual.

SUGGESTED INSTRUCTIONAL TIME: 0.15 2 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify and state purpose of items of common use shop machinery with 80% accuracy.

Learner can demonstrate how to use properly items of shop machinery with 85% accuracy.

TASK NUMBER: 0.16 TITLE: Know Performance Requirements of Standard Shop Operating Procedures.

INSTRUCTIONAL OBJECTIVE - 0.16: To Identify, State the Purpose and Use Procedural Guides Such as Shop Manuals, Flat Rate Manual, Charts, Manufacturer's Specifications, Parts Manual, Job Orders, Parts Requisitions Forms. State Meaning of Standard Shop Terms [Jargon] and How Used.

SKILLS: (Process Objectives)

0.161 - To identify and state purpose of shop operating procedures.
0.162 - How to use shop operating manuals, charts, forms and job orders.
0.163 - To identify and state use of common shop terminology.

RELATED TECHNICAL INFORMATION:

Contents of procedural guides cited in instructional objective.

SUGGESTED INSTRUCTIONAL TIME: 0.16, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify, state purpose, and use items covered during instruction with 80% accuracy.

SUB-BLOCK NUMBER 0.10 TITLE: Shop Operations and Safety

TASK NUMBER: 0.17 TITLE: Identify Types and Know Use of Common Automotive Fasteners.

INSTRUCTIONAL OBJECTIVE - 0.17: How to Identify, Select and Use the Proper Fastener for A Job.

SKILLS: (Process Objectives)

0.171 - Identify - Screws
Bolts
Nuts
Lock Washers
Cotterpins
Snap Rings
Keys and splines
0.172 - How to determine proper fastener for a job.
0.173 - How to use various types of fasteners.

RELATED TECHNICAL INFORMATION:

- Textbooks
- Manufacturer's catalogs
- Specifications Manuals

SUGGESTED INSTRUCTIONAL TIME: 0.17, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Learner can identify, state purpose of and use common automotive fasteners with 80% accuracy.

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.201 TITLE: Know Types, Purpose, Use, and Operator Care of Lubrication Items and Tires.

INSTRUCTIONAL OBJECTIVE - 0.201: To Identify Types, State Purpose, Use, and Perform Operator Care of Lubrication Items and Tires.

SKILLS: (Process Objectives)

0.2011 - Purpose and types of lubrication systems.
0.2012 - Identify major component parts and state purpose in lubrication system.
0.2013 - Purpose and types of tires.
0.2014 - Lubrication and tire tools and equipment.
0.2015 - How to perform operator maintenance of lubrication system and tires.

RELATED TECHNICAL INFORMATION:

See appropriate manuals and charts.

REQUIRED INSTRUCTIONAL TIME: 0.201, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can list types, state purpose, use, and care of lubrication and tire items with 80% accuracy.

TASK NUMBER: 0.202 TITLE: Know Purpose, Operation, Major Component Parts and Operator Care of the Cooling System.

INSTRUCTIONAL OBJECTIVE - 0.202: To State Purpose and Operation of Cooling Systems, Identify Major Component Parts and State Purpose; and Perform Operator Care.

SKILLS: (Process Objectives)

0.2021 - State purpose and operation of the cooling system.
0.2022 - Identify and state purpose of major component parts.
0.2023 - How to perform operator maintenance of cooling system.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals.

REQUIRED INSTRUCTIONAL TIME: 0.202, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify each major component of system, state purpose and operation, and perform operator maintenance with 80% accuracy.

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance. (cont'd.)

TASK NUMBER: 0.203 TITLE: Know Purpose, Operation, Major Parts and Operator Care of Automotive Heater System.

INSTRUCTIONAL OBJECTIVE - 0.203: To State Purpose and Operation of Automotive Heater System, Identify Major Component Parts and State Purpose; and Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2031 - Purpose and operation of heater system.
0.2032 - Identification of major component parts of heater system and purpose.
0.2033 - How to perform operator maintenance of heating system.

REQUIRED TECHNICAL INFORMATION:

See appropriate shop manuals and charts.

REQUIRED INSTRUCTIONAL TIME: 0.203, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify each major component of the system, state its purpose and operation, and perform operator maintenance with 80% accuracy.

TASK NUMBER: 0.204 TITLE: Know Purpose, Operation, Major Parts and Operator Care of the Braking System.

INSTRUCTIONAL OBJECTIVE - 0.204: To State Purpose and Describe Operation of Braking System, Identify and State Purpose of Major Component Parts, and Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2041 - Purpose and operation of braking system.
0.2042 - Identification of major component parts and purpose.
0.2043 - How to perform operator maintenance.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals and manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 0.204, 16 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify each major component of braking system, state its purpose and operation, and perform operator maintenance with 80% accuracy.

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance. (cont'd.)

TASK NUMBER: 0.205 TITLE: Know Purpose, Types of Fuel, System Operation, Major Parts, and Operator Care of Fuel System.

INSTRUCTIONAL OBJECTIVE - 0.205: To State Purpose and Describe System Operation of Fuel System; Identify Major Parts and State Purpose; State Types and Characteristics of Motor Fuels; and How to Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2051 - Purpose and system operation of fuel system.
0.2052 - Identification of major component parts and purpose.
0.2053 - State types and characteristics of motor fuels.
0.2054 - How to perform operator maintenance of fuel system.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals and manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 0.205, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify each component of the fuel system, state its purpose and operation, state types and characteristics of motor fuels, and perform operator maintenance with 80% accuracy.

TASK NUMBER: 0.206 TITLE: Know Purpose, Operation, Major Parts, and Operator Care of Steering System and Front End.

INSTRUCTIONAL OBJECTIVE - 0.206: To State Purpose and Describe Operations of Steering System and Front End; Identify and State Purpose of Major Component Parts; and How to Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2061 - Purpose and system operation.
0.2062 - Identification of major component parts and purpose.
0.2063 - How to perform operator maintenance.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals and manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 0.206, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify each major component part of the steering system and front end, state its purpose and operation, and perform operator maintenance with 80% accuracy.

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance. (cont'd)

TASK NUMBER: 0.207 TITLE: Know Purpose, Operations, Major Parts, and Operator Care of the Power Train with Manual Transmission.

INSTRUCTIONAL OBJECTIVE - 0.207: To State Purpose and Operation of the Power Train with Manual Transmission; Identification and Purpose of Major Component Parts; and How To Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2071 - State purpose and describe operation of the power train with manual transmission.
0.2072 - Identification of the major component parts and purpose.
0.2073 - How to perform operator maintenance.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals and manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 0.207, 16 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify each major component part of the power train with manual transmission, state its purpose and operation, and perform operator maintenance with 80% accuracy.

TASK NUMBER: 0.208 TITLE: Know Purpose, Operations, Major Parts and Operator Care of Engine.

INSTRUCTIONAL OBJECTIVE - 0.208: To State Purpose and Describe the Operation of The Engine; Identify the Major Component Parts and State Purpose; and how to Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2081 - Purpose and operation of the engine.
0.2082 - Identification of the major component parts and purpose.
0.2083 - How to perform operator maintenance.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals, parts manuals, and manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 0.208, 20 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner can identify each major component part of the engine, state its purpose and operation, and perform operator maintenance with 80% accuracy.

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance. (cont'd.)

TASK NUMBER: 0.209 TITLE: Know Purpose, Operation, Major Parts and Operator Care of Automobile Air Conditioners.

INSTRUCTIONAL OBJECTIVE - 0.209: To State Purpose and Describe Operation of Automobile Air Conditioner; Identify and State Purpose of Major Component Parts; and How To Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2091 - Purpose and operation of automobile air conditioner system.
0.2092 - Identification and purpose of major component parts.
0.2093 - How to perform operator maintenance.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals, manufacturer's specifications and manuals.

REQUIRED INSTRUCTIONAL TIME: 0.209, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

The learner can identify each major component part of the air conditioner system, state its purpose and operations, and perform operator maintenance with 80% accuracy.

TASK NUMBER: 0.210 TITLE: Know Purpose, Operations, Major Parts, and Operator Care of Automatic Transmission.

INSTRUCTIONAL OBJECTIVE - 0.210: To State Purpose and Describe Operation of Automatic Transmission; Identify and State Purpose of Major Component Parts; and How To Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2101 - Purpose and operation of the automatic transmission.
0.2102 - Identification and purpose of major component parts.
0.2103 - How to perform operator maintenance.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals.

REQUIRED INSTRUCTIONAL TIME: 0.210, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

The learner can identify each major component part of the automatic transmission, state its purpose and operations, and perform operator maintenance with 80% accuracy.

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance. (cont'd.)

TASK NUMBER: 0.211 TITLE: Know Purpose, Operations, Major Parts, and Operator Care of the Automotive Electrical System.

INSTRUCTIONAL OBJECTIVE - 0.211: To State Purpose and Describe Operation of Automotive Electrical System; Identify and State Purpose of Major Component Parts; and How to Perform Operator Maintenance.

SKILLS: (Process Objectives)

0.2111 - Purpose and operation of the automotive electrical system.
0.2112 - Identification and purpose of major component parts.
0.2113 - How to perform operator maintenance.

RELATED TECHNICAL INFORMATION:

See appropriate shop manuals.

REQUIRED INSTRUCTIONAL TIME: 0.211, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

The learner can identify each major component part of the electrical system, state its purpose and operation, and perform operator maintenance with 80% accuracy.

SUB-BLOCK NUMBER: 0.30 TITLE: The Automotive Technician

TASK NUMBER: 0.31 TITLE: Know Opportunities and Job Availability for the Automotive Technician.

INSTRUCTIONAL OBJECTIVE - 0.31: To Know Opportunities and Job Availability for the Automotive Technician.

SKILLS: (Process Objectives)

0.311 - State types of job opportunities for the automotive technician; pay, etc.
0.312 - State job availabilities in North Carolina, the demand and the supply.

RELATED TECHNICAL INFORMATION:

The Employment Service Commission reports. Reports of the Independent Garage Owners Association. Local help wanted ads.

REQUIRED INSTRUCTIONAL TIME: 0.31, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner demonstrates evidence of knowing the job opportunities for the automotive technician.

SUB-BLOCK NUMBER: 0.30 TITLE: The Automotive Technician (cont'd.)

TASK NUMBER: 0.32 TITLE: Know How to Get A Job, Hold A Job, and Earn Advancement.

INSTRUCTIONAL OBJECTIVE - 0.32: How to Get A Job, Hold A Job, and Earn Advancement.

SKILLS: (Process Objectives)

0.321 - How to get a job. (Good performance record in instructional program, resulting in a certificate of qualification and good references. Good attitude, make good first impression with appearance and response to questions, etc.)
0.322 - How to hold a job. (Reliability, good worker, make few mistakes, show evidence of ability, follow instructions, etc.)
0.323 - How to earn advancement. (Quality performance, show improvement, seek greater responsibilities, show interest in work, work on self improvement, be neat in person, neat and organized in work area, etc.)
0.324 - How to complete a standard job application form.

RELATED TECHNICAL INFORMATION:

Study shop manuals and other appropriate automotive technical references to better prepare self and make an effort to pass tests given by the National Institute for Automotive Service Excellence. See job application forms.

REQUIRED INSTRUCTIONAL TIME: 0.32, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner gives evidence of practicing items cited in process objectives. Learner can list factors in getting and holding a job and qualifying for advancement, with 90% accuracy.

TASK NUMBER: 0.33 TITLE: Know How to Meet People and To Be Accepted By Fellow Employees.

INSTRUCTIONAL OBJECTIVE - 0.33: How to Meet People and To Be Accepted By Fellow Employees.

SKILLS: (Process Objectives)

0.331 - How to meet people and make a good impression.
0.332 - How to be accepted by fellow employees. (Be honest, do your share of the work, be willing to help others, return what you borrow, get your own tools, try to get along, don't pretend to be what you aren't, practice shop etiquette, etc.)

RELATED TECHNICAL INFORMATION:

Reference material on human relations and motivation, ie: Psychology (Human Relations and Motivation) Laird, Donald A., and Laird, Eleanor. Fourth Edition; Gregg Division, McGraw-Hill Book Company, New York, Dallas, 1967.; etc. See also Fifth Edition - Laird, Laird, Fruehling, and Swift - 1975, same title as Fourth Edition.

REQUIRED INSTRUCTIONAL TIME: 0.33, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner gives evidence of applying instruction in his daily performance in class. Learner can list key items cited in the process objectives with 80% accuracy.

SUB-BLOCK NUMBER: 0.30 TITLE: The Automotive Technician (cont'd.)

TASK NUMBER: 0.34 TITLE: Know The Technician's Responsibilities Toward His Employer, The Customer, and His Craft.

INSTRUCTIONAL OBJECTIVE - 0.34: To Know Technician's Responsibilities Toward His Employer, The Customer, and His Craft.

SKILLS: (Process Objectives)

0.341 - How to demonstrate responsibility toward one's employer.
0.342 - How to demonstrate responsibility toward the customer.
0.343 - How to demonstrate responsibility toward the automotive service craft.

RELATED TECHNICAL INFORMATION:

Mechanic Testing and Certification Programs; See references in 0.33; rules and policies of the Better Business Association; etc.

REQUIRED INSTRUCTIONAL TIME: 0.34, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

Learner gives evidence of practicing in class the considerations cited in the process objectives. Learner can list items cited as key elements in responsibility to employer, customer, and craft, with 80% accuracy.

NOTE:

Special tools, equipment, and machines used for a specific task or in one block of instruction only, should be covered in the instruction for that task or block. Appropriate safety considerations will be repeated with each instructional objective. Compliance with and knowledge of the appropriate portions of the Occupational Safety and Health Act [OSHA], by all concerned, is essential.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 0:0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.10 TITLE: Shop Operations and Safety

Hand Tools:

- Screwdrivers
  - Standard
  - Phillips point
  - Reed and prince
  - Offset
  - Clutch Type
- Pliers
  - Combination
  - Water pump pliers
  - Needle nose
  - Diagonal cutting pliers
  - Snap ring pliers
  - Vise grips
- Hammers
  - Ball peen hammers
  - Plastic tip hammers
  - Brass hammers
  - Rubber mallets
- Chisels and Punches
  - Flat chisel
  - Cape chisel
  - Diamond point chisel
  - Center punch
  - Prick punch
  - Starting punch
  - Pin punch
- Wrenches
  - Open end
  - Box end
  - Combination
  - Adjustable wrenches
  - Pipe wrenches
  - Tubing wrenches
- Socket Wrenches
  - 12 point
  - 8 point
  - 6 point
  - Deep sockets
  - Universal joint sockets
  - Handles and drivers
  - Extensions
- Torque Wrench
- Allen Wrenches
- Files
  - Flat
  - Round
  - Halfround
  - Triangular
- Hack Saw
  - Fine tooth
  - Coarse tooth
- Hole Saw
- Bench Vise
- C Clamp

Power Tools:

- Drills
  - 1/4"
  - 3/8"
  - 1/2"
  - Rotary brushes
  - Rotary files
  - Rotary stones
- Bench Grinder
  - Grinding stone
  - Wire wheel
  - Buffing wheel

- Vehicle Hoist

- Drill Press

- Hydraulic Press

- Impact Wrench

- Air Chisel

- Parts Washer

- Hydraulic Jack

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology (Con't.)

SUB-BLOCK NUMBER: 0.10 TITLE: Shop Operations and Safety

Fasteners:

- Screws and Bolts
  - Hexagon
  - Square
  - Locking
  - Wing nut
  - Washer face
  - Castellated
  - Hex cap nut (acorn)
- Keys
  - Woodruff
  - Cotter key
- Snap rings
  - Internal
  - External
  - Tru arc
  - Wire
  - Square cut
- Screw Extractor
- Helicoil Insert
- Thread Cutting taps & die

Various Shop Manuals
Flat Rate Manual
Parts Manual
Manufacturer's Specifications
Job Order Forms
Shop Charts (Lubrication, etc.)
First Aid Kit
Fire Extinquishers

Measuring Tools:

Machinist Rule
Micrometer, outside
Micrometer, inside
Telescoping Gauge
Universal Dial Indicator
Cylinder Gauge
Feeler Gauge
Straight Edge
Vernier Calipers

Working Models:

To improve instruction in Sub-Block 0.20 it is strongly recommended that an effort be made to obtain working major assemblies mounted for display and instruction. These should be separated from the vehicle where appropriate. This should be in addition to a shop vehicle. Many automobile dealerships are willing to arrange to provide the assemblies at little or no cost to public institutions for instructional purposes.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

TASK

00.11
- a. State or list five major automotive repair shop safety hazards. (Oral or written) (5 points)
- b. Demonstrate or list safety practices required to prevent injury from hazards listed above. (Demonstrate or write) (5 points)

STANDARD: 90% accuracy total (10 minutes).

00.12
- a. State or identify five first aid items required for common shop injuries and the injury with which used. (oral, list, or identify) (5 points)
- b. Demonstrate how to use the items identified above. (applied performance) (10 points)

STANDARD: 90% accuracy total (10 minutes).

00.13
- a. Identify ten common shop tools placed in a display and numbered by the instructor. (written or oral from display) (10 points)
- b. State purpose of tools identified. (written or oral) (10 points)
- c. Demonstrate proper use of five tools identified and user care required. (applied performance) (5 points)

STANDARD: 80% accuracy total (10 minutes).

00.14
- a. Identify and state purpose of ten items of common shop equipment designated by the instructor. (written or oral from display) (10 points)
- b. Demonstrate proper use of five items identified. (applied performance) (10 points)
- c. Demonstrate proper user maintenance of the five items used above. (applied performance) (5 points)

STANDARD: 80% accuracy total (15 minutes).
Shows ability to use 80% of items correctly for appropriate purpose and perform user maintenance.

00.15
- a. Identify and state purpose of five common shop machines designated by the instructor. (written or oral from display) (5 points)
- b. Demonstrate or state proper use of five shop machines identified above. (applied performance or oral) (10 points)
- c. Demonstrate proper user maintenance of five shop machines identified above. (demonstration - applied performance) (5 points)

STANDARD: 80% accuracy total (15 minutes).

00.16
- a. Identify five standard shop operating procedures or procedural guides. (oral or written) (5 points)
- b. Demonstrate proper application or use of five standard procedures, use of parts manual, flat rate manual, etc., ie:
  - 1) Given names, model, year, and manufacturer of two automotive parts, find part numbers in appropriate parts catalogue. (performance and written) (4 points)
  - 2) Determine manufacturer's specifications from manual for adjusting two common automotive components as given by instructor. (performance and written) (4 points)
  - 3) Determine flat rate from manual for one specific repair job

BLOCK OR DIVISION NUMBER 0.0 TITLE: Introduction to Automotive Technology

TASK

specified by instructor. (performance and written) (2 points)
STANDARD: 80% accuracy total (15 minutes).

00.201 a. Identify five major components of lubrication system and state purpose of each. (oral or written) (6 points)
b. Demonstrate operator maintenance, (on a vehicle) required for the lubrication system and tires. (applied performance) (4 points)
STANDARD: 80% correct (10 minutes).

00.202 a. Identify and state purpose of four major components of the cooling system in vehicle specified. (oral or written) (8 points)
b. Perform minimum operator maintenance for cooling system. (applied performance) (2 points)
STANDARD: 80% correct (5 minutes)

00.203 Identify and state purpose of three major components of automotive heating system in vehicle specified as designated by instructor. (oral or written and applied performance) (5 points)
STANDARD: 80% correct (5 minutes).

00.204 Identify and state purpose of five major components of standard automotive power brake system as designated by instructor. (oral or written and applied performance) (10 points)
STANDARD: 80% correct (10 minutes).

00.205 a. Identify (½) and state purpose (½) of five major components of the automotive fuel system. (Oral and applied performance) (10 points)
b. List three types of common gasoline; state their characteristics and use. (written) (10 points)
STANDARD: 80% correct (10 minutes).

00.206 a. Identify and state purpose of five major components of the automotive steering system and front end as designated by instructor. (oral and applied performance) (15 points)
b. Show what vehicle operator can do that will contribute to improving or maintaining ease of steering. (written or oral) (5 points)
STANDARD: 80% correct (10 minutes).

00.207 a. State purpose of power train and manual transmission assemblies. (oral or written) (4 points)
b. Identify and state purpose of five major components of the manual transmission and three major components of the power train as designated by the instructor. (oral or written) (16 points)
STANDARD: 80% correct total (10 minutes).

00.208 a. Identify and explain the cycles of operation of the standard, gasoline-powered automobile engine. (oral or written) (8 points)
b. Identify and state the purpose of five major components of the gasoline engine designated by the instructor. (oral - at vehicle or engine) (10 points)

TEST ITEMS (cont'd)

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

TASK

c. Demonstrate the primary operator function in engine maintenance. (applied performance) (2 points)
STANDARD: 80% accuracy (15 minutes).

00.209 a. State the operational cycles of the automotive air conditioner. (oral or written) (5 points)
b. Identify and state purpose of five major components of the air conditioner designated by the instructor. (oral or written) (10 points)
STANDARD: 80% accuracy (10 minutes).

00.210 a. State purpose of automatic transmission and name three types. (oral or written) (4 points)
b. Perform appropriate automatic transmission operator maintenance on vehicle designated. (applied performance) (1 point)
STANDARD: 80% accuracy (10 minutes).

00.211 a. Identify and state purpose of five major components of the electrical system designated by the instructor. (oral or written) (10 points)
b. Perform the normal operator maintenance for the component of the electrical system designated. (applied performance) (5 points)
STANDARD: 80% accuracy (10 minutes).

00.31 No test item.

00.32 a. List or state three performance requirements for holding a job. (written or oral) (3 points)
b. List or state two performance requirements to earn advancement. (written or oral) (2 points)
STANDARD: 80% accuracy (15 minutes).

00.33 List or state five characteristics a worker should have and practice to get along with his fellow workers. (oral or written) (5 points)
STANDARD: 80% accuracy (5 minutes).

00.34 List or state the mechanic's responsibilities toward one's employer, the customer, and his craft. (oral or written) (5 points)
STANDARD: 80% accuracy (8 minutes).

NOTE: Points allocated serve to provide a weight to the element of the test item for evaluation purposes. Test item response totaling under 80% should not be counted when determining occupational qualification. To meet qualification standards for this block of instruction, the student must meet the minimum performance standard stated on at least 80% of the test items. This block is prerequisite for all other blocks of instruction.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation and Operator Maintenance.

TASK NUMBER: 0.201 TITLE: Know Types, Purposes, Use, and Operator Care of Lubrication Items and Tires.

Related Technical Information:

(Select correct answer, show choice by circling the correct letter).

1. The two main types of tubeless tires are the

   a. belted and unbelted.
   b. belted bias and radial.
   c. belted-radial and bias-ply.

2. According to many tire experts, the tire that gives the best mileage is

   a. belted bias tire.
   b. belted-radial tire.
   c. bias-ply tire.

3. It is OK to use regular snow tires on the rear provided the front tires are

   a. belted radials.
   b. not belted radials.
   c. tubeless tires.

4. With the tubeless tire, the air is retained between the

   a. tube and rim.
   b. tire casing and rim.
   c. tire tread and casing.

5. Wear on the tread shoulders indicates the tire has been

   a. driven at high speed.
   b. operated underinflated.
   c. operated overinflated.

6. Wear on the center of the tread indicates the tire has been

   a. driven at high speed.
   b. operated underinflated.
   c. operated overinflated.

TEST ITEMS (Con't.)

7. When removing a wheel from a car, loosen the nuts

   a. before jacking up the car.
   b. after jacking up the car.
   c. after removing the tire from the rim.

8. The oil that most car manufacturers recommend is

   a. 30 wt HD.
   b. 20 wt ML.
   c. 10/40 wt.

9. The automobile should be lubricated

   a. when the customer gets around to it.
   b. every 6 months or 25,000 miles.
   c. as per manufacturer's recommendations.

10. After changing the oil and filter, the oil light should go out in less than

   a. one minute.
   b. two minutes.
   c. 30 seconds.
   d. 45 seconds.

Note: The above test items may also be used with Block 1.0, Lubrication and Vehicle Operating Maintenance, to test knowledge of related technical information, for that block.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.202 TITLE: Know Purpose, Operation, Major Component Parts and Operator Care of the Cooling System.

Related Technical Information

Multiple Choice: (Select correct answer, show choice by circling the correct letter.)

1. The water pump is driven from the

   a. camshaft.
   b. engine fan.
   c. crankshaft timing gear.
   d. crankshaft pulley.

2. The device in the cooling system that restricts water circulation when the engine is cold is called

   a. pump.
   b. bypass.
   c. thermostat.
   d. pressure cap.

3. Two types of antifreeze are alcohol base and

   a. heptane.
   b. ethylene glycol.
   c. tetraethyl.
   d. octane.

4. The device in the cooling system that increases the boiling point of the coolant in the radiator is called the

   a. pressure cap.
   b. water pump.
   c. bypass valve.
   d. atmospheric valve.

5. Many cars with automatic transmissions use transmission oil coolers with cooler tubes located in the radiator

   a. bottom tank.
   b. top tank.
   c. expansion tank.
   d. clearing tank.

TEST ITEMS (Con't.)

6. The thermostat is located between the

   a. water pump and engine.
   b. radiator and water pump.
   c. top of engine and radiator.
   d. water pump and water jackets.

7. Pressurizing the cooling system increases the boiling point of water, for each added pound of pressure, about

   a. 4.25°F.
   b. 1.8°C.
   c. 15 PSI.
   d. 250°F.

8. Two types of radiators are

   a. tube-and-fin & ribbon-cellular.
   b. down-flow and cross-flow.
   c. expansion-type and sealed-type.
   d. full-flow and restricted-flow.

9. Two types of cooling systems are liquid-cooled and

   a. water-cooled.
   b. air-cooled.
   c. antifreeze-cooled.
   d. siphon-cooled.

10. The purpose of the bypass in the cooling system is to permit water to circulate when the

    a. thermostat is open.
    b. engine is idling.
    c. thermostat is closed.
    d. pump is operating.

Note: The above test items may also be used in the testing of knowledge of related technical information for Block 2.0, Cooling System Maintenance and Repair.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.203 TITLE: Know Purpose, Operation, Major Parts and Operator Care of Automotive Heater System.

Related Technical Information:

Multiple Choice: (Select correct answer, show choice by circling letter a, b, or c.)

1. In the simple car heater described in the book, there are three doors - the temperature door, the air door, and the

    a. air-conditioner door.
    b. cooler door.
    c. defroster door.

2. Car heater problems usually result in failure of the blower to work, in leaks, and in

    a. no cooling.
    b. no heat.
    c. no air circulation.

3. The heat for the car heater comes from

    a. exhaust manifold.
    b. the cooling system.
    c. hot air.

4. The amount of heat that gets into the car interior is determined by

    a. amount of air that flows through the heater core.
    b. amount of coolant that flows through the radiator.
    c. amount of air in the cooling system.

5. The valve that controls the coolant going into the heater core is called

    a. expansion valve.
    b. air valve.
    c. heater control valve.

Note: The above test items may also be used in the testing knowledge of related technical information for Block 3.0, Automobile Heater Maintenance and Repair.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.00 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.204 TITLE: Know Purpose, Operation, Major Parts, and Operator Care of the Braking System.

Related Technical Information:

Multiple Choice: (Select correct answer, show choice by circling the correct letter).

1. The fastest stop will be made with

   a. the wheels rotating.
   b. the wheels locked.

2. What material is used mostly for the braking surface of brake drums?

   a. cast iron.
   b. steel.
   c. aluminum.

3. Brake bleeding is a procedure to

   a. eliminate air from the hydraulic system.
   b. remove excess fluid to reduce brake pressure.
   c. filter contamination from the fluid.
   d. make final brake shoe adjustment.

4. One of the main advantages of disc brakes over drum brakes is that the disc brake

   a. lasts longer.
   b. is more fade resistant.
   c. weighs less than drum brakes.
   d. requires less pedal force to stop the vehicle.

5. Most cars with drum brakes have

   a. two wheel cylinders per wheel.
   b. three wheel cylinders per wheel.
   c. one wheel cylinder per wheel.

6. The main advantage of a dual braking system is

   a. reservoir will hold more fluid.
   b. if one side of the master cylinder goes out, you will still have brakes.
   c. requires less pedal force to stop the vehicle.

7. The main reason that most cars do not have disc brakes on the rear is

   a. too costly.
   b. hard to adapt emergency brakes.
   c. would require too much pedal effort.

8. Primary and secondary brake linings are made of

   a. the same materials.
   b. different materials.

9. When cleaning hydraulic brake parts, what type cleaning fluid should be used?

   a. alcohol.
   b. cleaning solvent.
   c. kerosene.

10. Friction is the same for all materials.

    a. true
    b. false

Note: The above test items may also be used in the testing of knowledge of related technical information for Block 4.0, Braking System Maintenance and Repair.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.00 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.205 TITLE: Know Purpose, Types of Fuel, System Operation, Major Parts, and Operator Care of Fuel System.

Related Technical Information:

Multiple Choice: (Select one statement as answer and circle the letter.)

1. In most cars the fuel pump is driven by the

   a. crankshaft.
   b. camshaft.
   c. water pump.
   d. vibration damper.

2. The fuel gauge sending unit is located

   a. on the back of the instrument cluster.
   b. in the engine block.
   c. in the fuel tank.

3. In order for gasoline to burn rapidly and completely, it must be

   a. liquified.
   b. in droplet form.
   c. vaporized.

4. The fuel air mixture is forced into the cylinder by

   a. the intake stroke of the piston.
   b. the compression stroke of the piston.
   c. the power stroke of the piston.

5. The basic principle of carburetor operation is

   a. pressure from the fuel pump.
   b. differences in the air pressure.
   c. heat from the exhaust manifold.

6. When starting an engine, the fuel mixture should be

   a. rich.
   b. lean.
   c. average.

7. The average fuel/air mixture is

   a. 16 parts air/one part gasoline.
   b. 16 parts gasoline/one part air.
   c. 20 parts air/one part gasoline.
   d. 8 parts air/one part gasoline.

8. The efficiency and economy of a vehicle are governed by

   a. the fuel system alone.
   b. the fuel system and the ignition system.
   c. the above two factors plus driver habits, wind resistance, differential ratio, type of transmission, etc.

9. The charcoal canister recovers

   a. fuel vapors.
   b. exhaust vapors.
   c. oil vapors.
   d. all of the above.

10. The carburetor air filter should be changed

   a. every 10,000 miles.
   b. every six months.
   c. as per manufacturer's specifications.

NOTE: The above test items may also be used in the testing knowledge of related technical information for Block 5.0, Fuel System Maintenance and Repair.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.206 TITLE: To State Purpose and Describe Operations of Steering System and Front End; Identify and State Purpose of Major Component Parts; and How to Perform Operator Maintenance.

Related Technical Information:

(Answer In Short Written (Oral) Statements)

1. What is the purpose of the steering system?

2. Name 5 steering system components.

3. What type of lubricant is used in power steering pumps?

4. What is the purpose of the shock absorbers?

5. When should a front end be aligned?

Note: The above test items may also be used with Block 6.0, Steering and Front End Maintenance and Repair, to test knowledge of related technical information.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.00 TITLE: Introduction to Automotive Technology

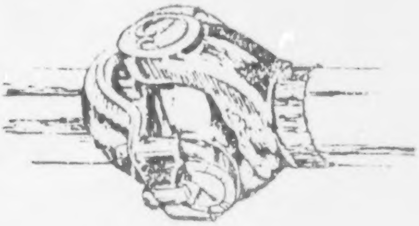
SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Operation, and Operator Maintenance

TASK NUMBER: .207 TITLE: Power Train and Manual Transmission: Know Purpose, Operations, Major Parts and Care

1. State the purpose of a transmission.
2. State the purpose of following items A through E and G, and identify the term F.
   a. Clutch disc
   b. Pressure plate
   c. Release bearing
   d. Release yoke
   e. Flywheel
   f. Free travel
   g. Pilot bearing
3. Describe the clutch operation in the following positions.
   a. Engaged
   b. Disengaged
4. List three types of pressure plates.
   a.
   b.
   c.
5. Write purpose of the drive line.
6. State the purpose of the following terms:
   a. Propeller shaft
   b. Slip joint
   c. Universal joint
   d. Center bearing support

TEST ITEMS (CON'T)

7. Identify the following universal joint as to type:



____

8. Name four major components of the power train.

9. What kind of lubricant is used in a standard transmission?

10. How often should the lubricant be checked in a differential?

11. What part or parts in the power train could cause vibration?

12. What is the purpose of the throwout bearing?

Competency Test: (Performance Requirement)

A. Given: 1) an automobile with a standard transmission; 2) twin-post lift; the trainee will:

1. Position vehicle on twin-post lift.
2. Lift vehicle.
3. Identify and state the purpose of the transmission, drive shaft, u-joints, and differential.
4. Lower the vehicle to the floor.

The trainee will perform the preceding tasks accurately (100%) and safely within 15 minutes. (If no hoist available, omit items 1, 2 and 4.)

B. Given: 1) an automobile with standard transmission; 2) an owner's handbook; the trainee will:

1. Find the preventative maintenance items that pertain to the power train.
2. Indicate the grease check points on the transmission and the differential.

The trainee will perform the preceding tasks accurately and safely within 15 minutes.

Note: Performance Standards - 80% correct response when five or more test items are used,

from the

TEST ANSWERS

1. Purpose of a transmission - To provide a method of varying the gear ratio between the engine and drive wheels.

2. a. Clutch disc - Provides friction between pressure plate and flywheel.

   b. Pressure plate - Provides pressure between pressure plate, clutch disc, and flywheel.

   c. Release bearing - Allows a method of releasing spring pressure of pressure plate.

   d. Release yoke - Linkage inside clutch housing used to engage and disengage clutch.

   e. Flywheel - Allows a working surface for the clutch assembly that is attached to it.

   f. Free travel - Amount of clutch pedal movement until release bearing contacts pressure plate.

   g. Pilot bearing - Located in crankshaft, allows for correct support and alignment of transmission input shaft.

3. a. Engaged - Spring pressure clamps clutch disc between pressure plate and flywheel face.

   b. Disengaged - Release bearing and linkage used to release pressure.

4. a. Diaphragm

   b. Coil spring

   c. Centrifugal

5. Purpose of the drive line - To carry the driving power from the transmission to the rear wheels.

6. a. Propeller shaft - Driving shaft that connects the transmission output shaft to the differential.

   b. Slip joint - Allows the propeller shaft to adjust to variations in length.

   c. Universal joint - Allows the propeller shaft to move up and down without breaking.

   d. Center bearing support - Supports the center of the propeller shaft when a two-piece drive line is used.

7. Cross and roller

Note: Written test items may also be used with Block 7.0 - Power Train and Manual Transmission to evaluate knowledge of related technical information for Block 7.0.

Test Items - Automotive Mechanic

BLOCK OR DIVISION NUMBER: 0.00 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle, Assembly Identification, Assembly and Vehicle Operation, and Operator Maintenance.

TASK NUMBER: .208 TITLE: Engine, Know Purpose, Operations, Major Parts, and Care.

INTRODUCTION TO AUTOMOTIVE TECHNOLOGY

(Engine Exhaust System)

Test Items

1. Write the purpose of the exhaust system.

2. List or state the purpose of each of the following exhaust items:

   a. Exhaust manifold

   b. Exhaust pipe

   c. Muffler

   d. Tail pipe

   e. Pipe clamps

   f. Pipe hangers

   g. Manifold heat control valve

   h. Resonator

   i. Crossover pipe

3. Describe the operation of the manifold heat control valve.

   a. Engine cold

   b. Engine warm

Test Answers

1. Purpose of the exhaust system - To conduct the burned gases from the engine, silence the noise of the exhaust, and direct it to the rear of the vehicle.

Test Answers (Con't)

2. a. Exhaust manifold - Usually cast iron; connects the engine exhaust ports to the exhaust pipe.

   b. Exhaust pipe - The pipe connecting the exhaust manifold to the muffler.

   c. Muffler - A unit through which the exhaust gases are passed to quiet the sounds of the running engine.

   d. Tail pipe - The exhaust pipe running from the muffler to the rear of the car.

   e. Pipe clamps - Used to clamp the exhaust pipe and tail pipe to the muffler.

   f. Pipe hangers - Used to support the exhaust system on the vehicle.

   g. Manifold heat control valve - A valve located in the exhaust manifold or exhaust pipe that deflect hot exhaust gas around the carburetor base during warm-up.

   h. Resonator - A small muffler-like device placed near the end of the tail pipe to provide additional silencing of the exhaust.

   i. Crossover pipe - A pipe used on V-type engines to connect exhaust manifolds together to enter a single exhaust pipe.

3. a. Engine cold - Heat control valve is shut to allow exhaust gas to pass under the carburetor to bring about better fuel atomization and warm-up.

   b. Engine warm - Heat control valve is open to allow exhaust gas to pass out the tail pipe.

Performance Standards: 80% correct responses.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 0.208 TITLE: Know Purpose, Operations, Major Parts and Operator Care of Engine.

ENGINE

Related Technical Information. Multiple Choice - circle the correct answer.

1. The gear ratio between camshaft and the crankshaft is such as to cause the camshaft to turn at

   a. the same speed as the crankshaft.
   b. half the speed of the crankshaft.
   c. twice the speed of the crankshaft.

2. The I-head valve train includes the camshaft, lifters, rocker arms, valves, and

   a. pull rods.
   b. push rods.
   c. connecting rods.

3. The two types of valve lifters are the solid and the

   a. hydraulic.
   b. rotary.
   c. hollow.

4. The automobile automotive engine is

   a. an external-combustion engine.
   b. an internal-combustion engine.
   c. a two-cycle engine.

5. Among the essential automotive engine parts are the

   a. crankshaft, valves, and piston.
   b. piston, rings and valves.
   c. cylinder head, piston and insert.

6. The upward movement of the piston traps the air-fuel mixture and

   a. ignites it.
   b. exhausts it.
   c. compresses it.

7. The four strokes in the four-cycle engine are

   a. compression, combustion, intake, exhaust.
   b. intake, compression, power, exhaust.
   c. intake, pressure, power, exhaust.

8. The two valves at the end of the cylinder are called the

   a. port and poppet valves.
   b. intake and exhaust valves.
   c. compression and power valves.

9. The number of cylinders in American passenger car engines is:

   a. four or eight
   b. three, four, six, or eight
   c. four, six, or eight

10. On V engines, the manifold between the two banks of cylinders is the:

   a. exhaust manifold
   b. V engine has no manifold there
   c. intake manifold

Competency Test: (Performance Required)

a) The student will identify and state the purpose of the major components of the engine.
b) The student will perform operator maintenance on the engine.

Competency Levels: (Performance Standards)

A. Given: 1) a head with valves in place; 2) piston and rod assembly; 3) camshaft; 4) crankshaft; 5) intake manifold; 6) exhaust manifold; the trainee will:

   1. Identify and state the purpose of the above components.

   2. Identify the intake and exhaust valve in the head.

The trainee will accomplish the preceding tasks accurately (100%) within 15 minutes.

B. Given: 1) an automobile; 2) several types of oil; the trainee will:

   1. Open the hood

   2. Check the oil

   3. Select the proper oil to be used in this vehicle (per manufacturer's specifications).

The trainee will accomplish the preceding tasks accurately (100%) and safely within 10 minutes.

Note: Performance Standards: 80% accuracy when five or more of items 1-10 are used.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.209 TITLE: Know Purpose, Operation, Major Component Parts and Operator Care of Automobile Air Conditioners.

Related Technical Information

Multiple Choice: (Select correct answer, show choice by circling the correct letter.)

1. The three essentials of the air conditioner are:

   a. cooler, compressor, and evaporator.
   b. compressor, condenser, and evaporator.
   c. evaporator, cooler, and expander.

2. The purpose of the compressor is to compress the vaporized refrigerant:

   a. before it leaves the condenser.
   b. before it enters the evaporator.
   c. after it leaves the evaporator.

3. In the evaporator, the:

   a. evaporated refrigerant is cooled to liquid.
   b. liquid refrigerant is evaporated.
   c. evaporator valve bleeds refrigerant to the condenser.

4. In the condenser, the refrigerant:

   a. warms up and turns to a liquid.
   b. runs toward the compressor.
   c. loses heat and turns to a liquid.

5. Air conditioners do two things to air; they:

   a. compress it and cool it.
   b. cool it and dry it.
   c. humidify it and cool it.

6. Refrigerant -12 boils:

   a. at -21.7° F.
   b. at +21.7° F.
   c. above normal room temperature.

TEST ITEMS (CON'T)

7. Heat is removed from the refrigerant by:

    a. lowering the pressure.
    b. passing it through the condenser.
    c. passing it through the evaporator.

8. The receiver-dehydrator in the system:

    a. raises the humidity.
    b. removes moisture from the refrigerant.
    c. removes oil trapped in the refrigerant.

9. The expansion valve is designed to:

    a. raise the refrigerant pressure.
    b. meter the refrigerant into the evaporator.
    c. removes oil trapped in the refrigerant.

10. Cold can be considered:

    a. form of energy.
    b. a positive force.
    c. absence of heat.

Note: 80% response accuracy for proficiency in above items.

Competency Test: (Performance Required)

1) The student will identify and state the purpose of the major components of the automotive air conditioning system

2) The student will perform operator maintenance on the automotive air conditioning system.

Competency Levels: (Performance Standards)

A. Given: 1) an air compressor; 2) receiver dryer; 3) evaporator; 4) condenser; 5) expansion valve; the trainee will:

    1. Identify and state the purpose of the above components.
    2. State the safety precautions to be observed when working on a vehicle equipped with an air conditioner.

The trainee will accomplish the preceding tasks accurately and safely within 15 minutes.

B. Given 1) an automobile equipped with an air conditioner; the trainee will:

    1. Identify the a) compressor, b) receiver dryer, c) evaporator, d) condenser, and e) expansion valve.
    2. Check the sight glass for refrigerant charge.

The trainee will accomplish the preceding tasks accurately and safely within 15 minutes.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.00 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Operation, and Operator Maintenance.

TASK NUMBER: 0.210 TITLE: Automatic Transmission: Know Purpose, Operations, Major Parts and Care.

1. The three major parts that comprise a torque converter are ____________________, ______________________________, and ______________________________.

2. The impeller is the driven member connected to the input shaft of the transmission.

   a. True
   b. False

3. The impeller and the turbine are connected by the stator.

   a. True
   b. False

4. The function of the torque converter is to transmit engine crankshaft output to the driveshaft.

   a. True
   b. False

5. A planetary gear system consists of a sun gear, planetary gears and an external gear.

   a. True
   b. False

6. The three basic systems in an automatic transmission are ________________________, planetary gear system and ______________________________.

7. The first fully automatic transmission on the American market was manufactured by:

   a. Ford
   b. Chrysler
   c. Packard
   d. Oldsmobile

8. Most modern automatic transmissions are:

   a. two speed
   b. three speed
   c. four speed

9. A servo is a device that:

   a. transforms hydraulic pressure into straight line mechanical action
   b. transforms mechanical action into hydraulic action
   c. steps up pressure to increase hydraulic power

TEST ITEMS (CON'T)

10. Multiple disc clutches are often used instead of single disc clutches in an automatic transmission.

    a. True
    b. False

Competency Test: (Performance Required)

a) The student will identify and state the purpose of the major components of an automatic transmission.

b) The student will perform operator maintenance on a car equipped with an automatic transmission.

Competency Levels: (Performance Standards)

A. Given: 1) torque converter; 2) composition clutches; 3) steel clutches; 4) valve body; 5) servo; 6) band; 7) oil pump; the trainee will:

    1. Identify and state the purpose of the above components.

The trainee will accomplish the preceding task within 15 minutes with 80% accuracy.

B. Given: 1) an automobile equipped with an automatic transmission; 2) several types of transmission fluid; the trainee will:

    1. Check the transmission fluid level.

    2. Select the transmission fluid that is correct for the vehicle.

The trainee will accomplish the preceding tasks accurately and safely within 15 minutes with with 100% accuracy.

Note: When five or more test items above are used, 80% correct response is required.

TEST ITEMS - AUTOMOTIVE MECHANIC

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation and Operator Maintenance.

TASK NUMBER: 0.211 TITLE: To State Purpose and Describe Operation of Automotive Electrical System; Identify and State Purpose of Major Component Parts; and How to Perform Operator Maintenance.

Related Technical Information:

Multiple Choice: (Select correct answer and show your choice by circling letter a, b, or c.)

1. Major components of the automotive electrical system include the battery,

   a. generator, ignition system, and radio.
   b. generator, regulator, and ignition system.
   c. generator, regulator, and air conditioner.

2. The two components of the cranking motor that are essential to its operation are the

   a. field windings and drive mechanism.
   b. armature and drive mechanism.
   c. armature and field windings.

3. The ignition system consists of the battery, ignition switch, spark plugs, wiring,

   a. ignition coil, and motor.
   b. ignition coil, and ignition relay.
   c. ignition coil, and ignition distributor.

4. The purpose of the resistor built into some spark plugs is to

   a. reduce wear of contact points.
   b. reduce radio and TV interference.
   c. improve high-speed performance.

5. Four indicating devices installed on the instrument panels of many cars are the ammeter and indicators that show

   a. oil pressure, fuel level, and engine temperature.
   b. oil pressure, fuel temperature, and engine temperature.
   c. oil level, fuel pressure, and engine temperature.

6. When removing a battery from a car, first

   a. disconnect the insulated terminal cable.
   b. loosen the battery hold-downs.
   c. disconnect the grounded terminal cable.

TEST ITEMS (Con't.)

7. To make possible ignition timing, engines usually have timing marks on the housing and the

   a. fan pulley or flywheel pulley.
   b. flywheel or dynamic balancer
   c. ignition distributor or flywheel.

8. The purpose of the resistor in the primary circuit of the ignition system is to

   a. protect contact points during cranking.
   b. reduce battery voltage on contact points during starting.
   c. protect contact points during engine operation.

9. The distributor shaft rotates at

   a. crankshaft speed.
   b. camshaft speed.
   c. twice crankshaft speed.

10. The distributor rotor is mounted

   a. in the housing.
   b. above the distributor cap.
   c. above the breaker cam.

NOTE: The above test items may also be used with Block 11.0, Automotive Electrical Systems, Maintenance and Repair, to test knowledge of related technical information.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI-N/A)

COURSE: Lubrication and Vehicle Operating Maintenance (Block 1.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently contained in T & I No. 7413 - Auto Service Station Specialist

Department of Community Colleges - Contained in AUT 1100 - Introduction to Auto Mechanics

INSTRUCTIONAL CONTACT HOURS: High Schools: 21
CC/TI: 21
(Time allocations for each instructional objective are suggested only.)

INSTRUCTIONAL OBJECTIVES:

To provide occupational qualification in the performance of the following:

1. How to change oil and filters.
2. How to lubricate vehicles and equipment.
3. How to remove, repair or replace tires, and to maintain equipment.
4. How to winterize vehicles.

(Service Manuals are part of Related Technical Information on each instructional objective page.)

JOB QUALIFICATION OR SKILLS GAINED:

This course or block of instruction when added to Block 0.0 qualifies the successful learner as an automotive lubrication specialist, to perform tire servicing, and as a service station specialist. Occupational qualification should be verified by a written examination on related technical information followed by a demonstrated performance evaluation (the primary means of evaluation), using standardized test items.

PREREQUISITES:

High Schools and post-secondary schools, Block 0.0 or evidence of knowledge and experience, verified by a demonstrated performance evaluation.

PERFORMANCE EVALUATION:

Test items (less specifics) for both written evaluation of knowledge of related technical information and for demonstrated performance evaluation for this block of instruction are appendices of the guide.

EQUIPMENT:

General tool list attached to last block. Special equipment and tools list peculiar to this block is attached to the block.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

AUTOMOTIVE TECHNOLOGY

BLOCK OR DIVISION NUMBER: 1.0 TITLE: Lubrication and Vehicle Operating Maintenance

TASK NUMBER: 1.01 TITLE: Change Oil and Filters.

INSTRUCTIONAL OBJECTIVE - 1.01: How To Change Oil and Filters.

SKILLS: (Process Objectives)

1.011 - How to change oil.
1.012 - How to change oil filters.

RELATED TECHNICAL INFORMATION:

Know location and identification of oil filters, drain plugs, filler caps and dip stick.
Know viscosity and/or property of oils.
Know different type filters.
See Manufacturers Specifications.

Required Instructional Time: 1.01, 6 hours.

Required Performance Standards:

1.011 - Changes oil according to manufacturer's specifications, using proper weight and quantity of oil. No leaks. Flat rate + 20%.
1.012 - Changes filter according to manufacturer's specifications, using proper filter, tightens to no leaks. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 1.0 TITLE: Lubrication and Vehicle Operating Maintenance (cont'd.)

TASK NUMBER: 1.02 TITLE: Lubricate Vehicles and Equipment

INSTRUCTIONAL OBJECTIVE - 1.02: How to Lubricate Vehicles and Equipment.

SKILLS: (Process Objectives)

1.021 - How to use lubrication equipment.
1.022 - How to lubricate vehicles and equipment.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.
Types and purposes of greases.

Required Instructional Time: 1.02, 4 hours.

Required Performance Standards:

1.021 - Follows manufacturer's specifications. Use proper lubricants for vehicle part.
1.022 - Wipes down all fittings prior to lubrication. Follows proper lubrication chart. Cleans all fittings of excess grease. Flat rate plus 20%.

BLOCK OR DIVISION NUMBER: 1.0 TITLE: Lubrication and Vehicle Operating Maintenance (cont'd.)

TASK NUMBER: 1.03 TITLE: Remove, Repair or Replace Tires, Maintain Equipment.

INSTRUCTIONAL OBJECTIVE - 1.03: How to Remove, Repair or Replace Tires, Maintain Equipment.

SKILLS: (Process Objectives)

1.031 - How to remove, repair or replace tires.
1.032 - How to maintain tire repair equipment.

RELATED TECHNICAL INFORMATION:

Know safety.
Know tire construction types, characteristics and purposes.
See Manufacturers Specifications.

Required Instructional Time: 1.03, 4 hours.

Required Performance Standards:

1.031 - Removes and replaces tire observing safety precautions, in 1/2 hour or less. Wheel lugs tightened to proper torque, wheel cover secure. Repairs tire correctly for tire problem within length of time considered reasonable by instructor (Approx. _____). No loss of air pressure when tested mounted on wheel, in water. Tire has prescribed air pressure.
1.032 - Follows manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 1.0 TITLE: Lubrication and Vehicle Operating Maintenance (cont'd.)

TASK NUMBER: 1.04 TITLE: Winterize Vehicles.

INSTRUCTIONAL OBJECTIVES - 1.04: How to Winterize Vehicles.

SKILLS: (Process Objectives)

1.041 - How to winterize vehicles.
1.042 - How to check coolant and use hydrometer.
1.043 - How to make necessary service checks; windshield washer reservoir coolant, engine and radiator coolant, tires, weight of engine oil.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.
Types of coolants and characteristics.

Required Instructional Time: 1.05, 6 hours.

Required Performance Standards:

1.04 Winterizes vehicle in flat rate + 20% time. All manufacturer's specifications applicable followed correctly. Coolant at the proper mixture for anticipated temperature requirements. Read hydrometer accurately.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 1.0 TITLE: Lubrication and Vehicle Operating Maintenance

Air-operated grease gun
Air-operated transmission grease gun
Tire-changer (arrange with local shop if not available)

Anti-freeze tester
Tire gauge
Battery hydrometer
Battery charger
Oil spout
Transmission funnel
Oil filter wrench
Drain plug wrench
Tubeless tire repair tool
Jumper cables
Suction gun
Drain pan water
Drain pan oil
Gas can
Water can
Battery filler
Squirt can
Brake fluid dispenser
Tire repair kit (puncture)
Leak detector tank
Static wheel balancer (if not available, arrange with local shop)

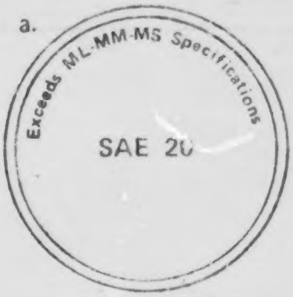
AUTOMOTIVE

Test Items

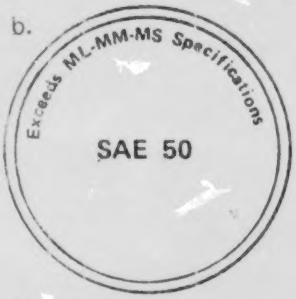
BLOCK OR DIVISION NUMBER: 1.0 TITLE: Lubrication

1 - 1.01 Select the oil best suited for a modern day engine that will be subjected to severe usage in cold temperatures.

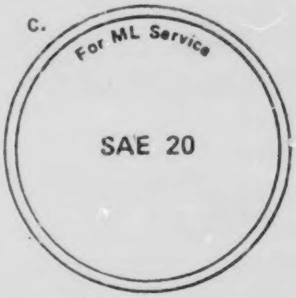
a.


Exceeds ML-MM-MS Specifications
SAE 20

b.


Exceeds ML-MM-MS Specifications
SAE 50

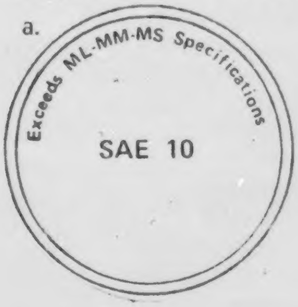
c.


For ML Service
SAE 20

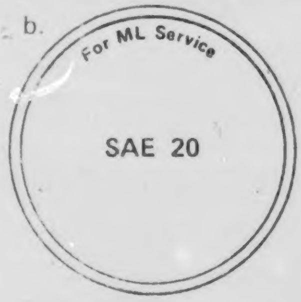
ANSWER ______________

2 - 1.01 Select the oil best suited for a modern day engine that will be subjected to severe usage and very high temperatures.

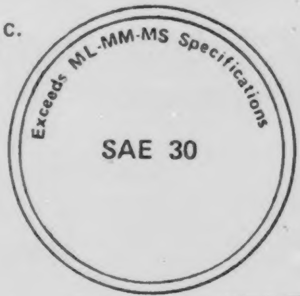
a.


Exceeds ML-MM-MS Specifications
SAE 10

b.


For ML Service
SAE 20

c.


Exceeds ML-MM-MS Specifications
SAE 30

ANSWER ______________

3 - 1.01 The student should demonstrate the ability to perform the following jobs to the satisfaction of the instructor, manufacturer's specifications, and flat rate plus 20%.

a) change oil in an engine
b) change an oil filter

TEST ANSWERS:

1) a
2) c
3) Performance skills will be evaluated by the instructor - flat rate plus 20% and as required by service manual.

NOTE: Student must meet the performance standards of 80% of tasks to be job qualified for this block. Successful completion of Blocks 0.0, 1.0, 2.0, and 3.0 provide for job qualification as Service Station Specialist.

BLOCK OR DIVISION NUMBER: 1.0 TITLE: Lubrication and Vehicle Operator Maintenance

TASK TITLE: Lubricate Vehicles and Equipment

4 - 1.02 The student should demonstrate the ability to perform a lubrication job on a vehicle and equipment to the satisfaction of the instructor, manufacturer's specifications, and flat rate plus 20%. (Includes use of proper tools and equipment)

5 - 1.02 a. Student will demonstrate ability to use lubrication chart to determine lubrication requirements for automobile specified by instructor and for specific mileage and service period. (5 points) (5 minutes)

b. Student will designate to the instructor the fittings to be serviced in situation described in "a" above. (5 points) (5 minutes)

TASK TITLE: Remove, Repair or Replace Tires, Maintain Equipment

6 - 1.03 a. What safety precautions should be observed when removing and replacing a tire on a car? State reason.

b. The student should demonstrate the ability to remove tire, repair, replace, and maintain equipment to the satisfaction of the instructor, manufacturer's specification, and flat rate plus 20%.

7 - 1.03 Student will be given flat tire mounted on a wheel. Locate the leak(s). (5 points) (10 minutes)

TASK TITLE: Perform Road Service, Recovery and Towing

8 - 1.04 a. The student should list reasons why wrecker and equipment should be used to tow a car with bad brakes and automatic transmission. What safety precautions must be observed and legal requirements met.

b. The student should demonstrate the ability to perform road service, recovery, and towing to the satisfaction of the instructor, and operate wrecker equipment according to manufacturer's specifications.

TASK TITLE: Winterize Vehicles

9 - 1.05 a. The student should demonstrate the ability to winterize a vehicle, follow manufacturer's specifications in flat rate plus 20% time, and to the satisfaction of the instructor.

b. The student will make a hydrometer reading of radiator coolant and state additional coolant requirements (if any) to protect radiator from freezing at temperature specified by the instructor. (4 points) (5 minutes)

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI-N/A)

COURSE: Cooling System Maintenance and Repair (Block 2.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently contained in T & I 7403 and 7393 - Auto Mechanics III and Auto Engine Tune-Up III

Department of Community Colleges -
AUT 1100 - Introduction to Auto Mechanics

INSTRUCTIONAL HOURS: High Schools: 36: CC/TI: 36
(Time allocations for each instructional objective are suggested only.)

INSTRUCTIONAL OBJECTIVES:

To provide occupational qualification in the performance of inspection, maintenance, removal and replacement of cooling system components, including:

1. How to check coolant freezing point.
2. How to inspect and replace water hoses.
3. How to pressurize and inspect coolant system.
4. How to test and replace thermostats.
5. How to check overflow tanks and accessories.
6. How to remove and reinstall radiators.
7. How to chemically clean and flush cooling system.
8. How to remove and replace the water pump.
9. How to replace freeze plugs.

QUALIFICATION OR JOB SKILLS GAINED:

This block of instruction does not by itself provide a recognized job qualification. It is designed to occupationally qualify the successful learner to be capable of performing all normal tasks involving the inspection, maintenance, removal, and replacement of the components of the cooling system of the liquid cooled internal combustion engine. Occupational qualification should be verified by performance evaluation. Successful completion of this block plus Blocks 0.0 and 1.0 qualifies the learner as a service station specialist.

PREREQUISITES:

High Schools: Block 0.0 - Introduction to Automotive Technology.
CC/TI: Block 0.0 - Introduction to Automotive Technology.

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance and knowledge of related technical information. The test items are outline in nature and require specific data to complete the situation of problem for use in evaluation. All test items relate directly to the instructional objectives and performance adequacy is determined by the ability of the learner to meet the industry recognized performance standards.

EQUIPMENT REQUIREMENTS:

The general tool list is attached to the last block of this program. Special equipment and tools list peculiar to this block is attached.

NOTE: Service Manuals are considered as part of Related Technical Information.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

AUTOMOTIVE TECHNOLOGY

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair

TASK NUMBER: 2.01 TITLE: Check Coolant Freezing Point.

INSTRUCTIONAL OBJECTIVE - 2.01: How to Check Coolant Freezing Point.

SKILLS: (Process Objectives)

2.011 - How to check coolant levels, belts and filler caps.
2.012 - How to use pressure tester - cap and radiator.
2.013 - How to use anti-freeze tester.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.
See Parts Manual for parts identification.

Required Instructional Time: 2.01, 1 hour.

Required Performance Standards:

Performs hydrometer check in five minutes, reads accurately. Checks and inspects pressure cap and radiator in ten minutes. Inspects belts and checks tension in five minutes. Performs all tasks according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd.)

TASK NUMBER: 2.02 TITLE: Inspect and Replace Water Hoses.

INSTRUCTIONAL OBJECTIVE - 2.02: How to Inspect and Replace Water Hoses.

SKILLS: (Process Objectives)

2.021 - How to make visual check of coolant hoses and components.
2.022 - How to remove and replace coolant hoses.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 2.02, 1 hour.

Required Performance Standards:

2.021 - Visual check of hoses and components in five minutes. Detects defective hoses and leaks, if any.
2.022 - No leaks on completion, hoses undamaged. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd.)

TASK NUMBER: 2.03 TITLE: Pressurize and Inspect Coolant System.

INSTRUCTIONAL OBJECTIVE - 2.03: How to Pressurize and Inspect Coolant System.

SKILLS: (Process Objectives)

2.031 - How to pressurize coolant system.
2.032 - How to use pressure tester.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 2.03, 1 hour.

Required Performance Standards:

Performs hydrometer check in five minutes, reads accurately. Checks and inspects pressure cap and radiator in ten minutes. Inspects belts and checks tension in five minutes. Performs all tasks according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd

TASK NUMBER: 2.04 TITLE: Test and Replace Thermostat.

INSTRUCTIONAL OBJECTIVE - 2.04: How to Test and Replace Thermostat.

SKILLS: (Process Objectives)

2.041 - How to remove and test thermostat.
2.042 - How to replace thermostat.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 2.04, 4 hours.

Required Performance Standards:

Performs all tasks according to manufacturer's specifications. Flat rate time + 20%.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd.)

TASK NUMBER: 2.05 TITLE: Check Overflow Tank and Accessories.

INSTRUCTIONAL OBJECTIVE - 2.05: How to Check Overflow Tank and Accessories.

SKILLS: (Process Objective)

2.051 - How to make visual check of overflow system.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 2.05, 2 hours.

Required Performance Standards:

Checks overflow tank and hoses for leaks and detects, if any. Performs task in time considered reasonable by instructor. (Approximately ________.)

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd.)

TASK NUMBER: 2.06 TITLE: Remove and Reinstall Radiators.

INSTRUCTIONAL OBJECTIVE - 2.06: How to Remove and Reinstall Radiators.

SKILLS: (Process Objective)

2.061 - How to remove and reinstall radiators.

RELATED TECHNICAL INFORMATION:

See Parts Manual for parts identification.

Required Instructional Time: 2.06, 6 hours.

Required Performance Standards:

Follows manufacturer's specifications. No leaks upon completion of task. Flat rate time + 20%.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd.)

TASK NUMBER: 2.07 TITLE: Chemically Clean and Flush Cooling System.

INSTRUCTIONAL OBJECTIVE - 2.07: How to Chemically Clean and Flush Cooling System.

SKILLS: (Process Objective)

2.071 - How to clean and flush system.

RELATED TECHNICAL INFORMATION:

Know safety.
Know reason for flushing and when.

Required Instructional Time: 2.07, 4 hours.

Required Performance Standards:

Performs task according to manufacturer's specifications. Observes appropriate safety precautions. Time as considered reasonable by instructor. (Approx. _______.)

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd.)

TASK NUMBER: 2.08 TITLE: Replace Water Pump.

INSTRUCTIONAL OBJECTIVE - 2.08: How to Replace Water Pump.

SKILLS: (Process Objective)

2.081 - How to remove and replace water pump.

RELATED TECHNICAL INFORMATION:

Know why to replace pump.
See Manufacturers Specifications.
See Parts Manual for parts identification.

Required Instructional Time: 2.08, 8 hours.

Required Performance Standards:

Follows manufacturer's specifications. No leaks when task is completed. Flat rate time + 20%.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair (cont'd.)

TASK NUMBER: 2.09 TITLE: Replace Freeze Plugs.

INSTRUCTIONAL OBJECTIVE - 2.09: How to Replace Freeze Plugs.

SKILLS: (Process Objectives)

2.091 - How to make visual checks of freeze plugs.
2.092 - How to remove and replace freeze plugs.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 2.09, 3 hours.

Required Performance Standards:

2.091 - Follows proper procedures for checking for leaks and detects leaks if present.
2.092 - Follows manufacturer's specifications, with no leaks on completion of task. Flat rate time + 20%.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System

TASK NUMBER: 2.10 TITLE: Inspect, Replace and Adjust Belts.

INSTRUCTIONAL OBJECTIVE - 2.10,TITLE: How to Inspect, Replace and Adjust Belts.

SKILLS (Process Objectives)

How to:

2.101 - Remove belts.
2.102 - Replace belts.
2.103 - Adjust belts.

RELATED TECHNICAL INFORMATION:

- Manufacturer's Specifications
- Service Manuals

SUGGESTED INSTRUCTIONAL TIME: 2.10, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Manufacturer's specifications.
- Flate Rate plus 20% performance time.

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System

TASK NUMBER: 2.11 TITLE: Inspect, Remove and Replace Fan Clutches.

INSTRUCTIONAL OBJECTIVE - 2.11: How to Inspect, Remove and Replace Fan Clutches.

SKILLS: (Process Objectives)

How to:

2.111 - Inspect fan clutch.
2.112 - Remove fan clutch.
2.113 - Replace fan clutch.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Service manuals.

SUGGESTED INSTRUCTIONAL TIME: 2.11, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Task performed according to manufacturer's specifications.
- Task performed in Flat Rate plus 20% time.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System Maintenance and Repair

and

BLOCK OR DIVISION NUMBER: 3.0 TITLE: Automobile Heater Maintenance and Repair

Anti-freeze tester (coolant hydrometer)
Radiator pressure tester
Water can
Water drain pan
Soldering iron
Thermometer
Back flush adapter
Belt tension gauge

AUTOMOTIVE

Test Items

BLOCK OR DIVISION NUMBER: 2.0 TITLE: Cooling System

1) 2.01 List three reasons why a permanent antifreeze solution should be used in the cooling system at all times.

a)
b)
c)

2) 2.01 The students should demonstrate the ability to perform the following jobs to the satisfaction of the instructor, manufacturer's specifications, and flat rate plus 20%. (Includes use of proper tools and equipment.)

2.01 a) Remove, inspect, or replace V-belts.
b) Test antifreeze solution.
2.02 Inspect or replace coolant hoses.
2.03 Pressure test the cooling system.
2.04 Remove, check, and replace a thermostat.
2.05 Check overflow tank.
2.06 Remove or replace a radiator.
2.08 Remove or replace a water pump.

3) 2.07 Describe process to chemically clean and flush cooling system. (oral or written)

2.09 Identify the freeze plugs on engine. (oral)

TEST ANSWERS:

1) a) Prevents coolant from freezing
b) Boiling point of permanent antifreeze is higher than water
c) Reduces the corrosive action of water

2) Performance skills will be evaluated by the instructor as to student ability to meet minimum performance standards.

3) 2.07 - See service manual for vehicle.
2.09 - To instructor satisfaction

NOTE: Student must meet the performance standards of 80% of the tasks to be job qualified for this block. Successful completion of Blocks 0.0, 1.0, 2.0, and 3.0 provide for job qualification as Service Station Specialist.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - N/A)

COURSE: Automobile Heater Maintenance and Repair (Block 3.0) (A component of Automotive Heater and Air Conditioner Maintenance and Repair.)

COURSE DESCRIPTION: Department of Public Instruction - Not identified

Department of Community Colleges - Currently contained in
AHR 1101 - Automotive Air Conditioning and
AUT 1101 - Internal Combustion Engines

INSTRUCTIONAL CONTACT HOURS: High Schools: 30; CC/TI: 30
Conduct instruction concurrently with Block 9.0 Automotive Heater and Air Conditioner.

INSTRUCTIONAL OBJECTIVES:

To provide occupational qualification in the performance of tasks related to the automotive heater, as separate from the air conditioner, especially for those vehicles which do not have an air conditioner.

The specific instructional objectives include:

1. How to inspect and replace defroster hoses.

2. How to service heater control components.

3. How to replace heater water control cores.

4. How to service or replace circulating heaters.

5. How to diagnose heating system malfunctions.

QUALIFICATION OR JOB SKILLS GAINED:

This block of instruction does not by itself provide an industry recognized job specialty, since in most cases the job skills gained in this block are coupled with those involving the automotive air conditioner, resulting in qualification as a heating and air conditioning technician. The successful learner for this block of instruction is qualified to perform the normal tasks involving the inspection, servicing, removal and replacement, and troubleshooting of the automotive heater and its components. Occupational qualification should be verified by performance evaluation. This block would be most useful to the service station specialist and essential to the heating and air conditioning technician.

PREREQUISITES:

High Schools - Block 0.0 (Introduction to Automotive Technology)
CC/TI - Block 0.0 (Introduction to Automotive Technology)

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

AUTOMOTIVE TECHNOLOGY

BLOCK OR DIVISION NUMBER: 3.0 TITLE: Automobile Heater Maintenance and Repair

TASK NUMBER: 3.01 TITLE: Inspect and Replace Defroster Hose.

INSTRUCTIONAL OBJECTIVE - 3.01: How to Inspect and Replace Defroster Hose.

SKILLS: (Process Objectives)

3.011 - How to remove and replace defroster hose.
3.012 - How to check for leakage.

RELATED TECHNICAL INFORMATION:

See Parts Manual for parts identification.

Required Instructional Time: 3.01, 3 hours.

Required Performance Standards:

3.011 - Flat rate + 20%.
3.012 - Time Reasonable (Approx. time: ________) Detects leaks, if any.

BLOCK OR DIVISION NUMBER: 3.0 TITLE: Automobile Heater Maintenance and Repair (cont'

TASK NUMBER: 3.02 TITLE: Service Heater Control Components.

INSTRUCTIONAL OBJECTIVE - 3.02: How to Service Heater Control Components.

SKILLS: (Process Objectives)

3.021 - How to use testing equipment and special tools.
3.022 - How to use service manual.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.
Know theory and operation of components.
See Parts Manual for parts identification.

Required Instructional Time: 3.02, 8 hours.

Required Performance Standards:

3.021 - Follows manufacturer's specifications - item works properly.
Uses proper equipment and tools.
3.022 - Uses proper service manual. Can identify heater problem with correct service manual instructions.

BLOCK OR DIVISION: 3.0 TITLE: Automobile Heater Maintenance and Repair (cont'd.)

TASK NUMBER: 3.03 TITLE: Replace Heater Water Control Core.

INSTRUCTIONAL OBJECTIVE - 3.03: How to Replace Heater Water Control Core.

SKILLS: (Process Objective)

3.031 - How to remove and replace heater core.

RELATED TECHNICAL INFORMATION:

Know purpose of heater core.

Required Instructional Time 3.03, 8 hours.

Required Performance Standards:

3.031 - Flat rate manual + 20%.
Follows correct procedures, no leak, heater works properly.

BLOCK OR DIVISION NUMBER: 3.0 TITLE: Automobile Heater Maintenance and Repair (cont'd.)

TASK NUMBER: 3.04 TITLE: Service or Replace Circulating Heaters.

INSTRUCTIONAL OBJECTIVE - 3.04: How to Service or Replace Circulating Heaters.

SKILLS: (Process Objectives)

3.041 - How to service circulating heaters.
3.042 - How to remove and replace heater motors and air ducts.

RELATED TECHNICAL INFORMATION:

Know use of service manuals.

Required Instructional Time: 3.04, 8 hours.

Required Performance Standards:

3.041 - Flat rate manual + 20%. Uses service manual correctly.
3.042 - Flat rate manual + 20%. Uses service manual correctly.

BLOCK OR DIVISION NUMBER: 3.0 TITLE: Automobile Heater Maintenance and Repair (cont'd.)

TASK NUMBER: 3.05 TITLE: Diagnose Heating System Malfunctions.

INSTRUCTIONAL OBJECTIVE - 3.05: How to Diagnose Heating System Malfunctions.

SKILLS: (Process Objective)

3.051 - How to diagnose heating system.

RELATED TECHNICAL INFORMATION:

Know theory and operation of system.

Required Instructional Time: 3.05, 3 hours.

Required Performance Standards:

3.051 - Time considered reasonable by instructor. Follows proper sequence of inspection steps.

AUTOMOTIVE

Test Items

BLOCK OR DIVISION NUMBER: 3.0 TITLE: Auto Heater Maintenance and Repair

For a student to be certified in Block 3.0, he must meet minimum performance standards on the following: (Flate Rate Plus 20% Applies as the Alloted Time for All Tasks.)

Given proper tools and equipment, the student will perform operations 3.01 through 3.05.

3.011 Inspect and replace defroster hose.

3.012 Check for leakage.

STANDARD: Performed in the allotted time with no leaks.

3.021 Service heater control components.

3.022 Use testing equipment and special tools.

3.023 Use service manual.

STANDARD: Performed in allotted time using testing equipment properly and with no leaks.

3.03 Replace heater water control core.

STANDARD: Performed in allotted time with no leaks.

3.041 Service or replace circulating heaters.

3.042 Remove and replace heater motors and air ducts.

STANDARD: Performed in allotted time with no leaks, no missing parts and all clamps and bolts tightened to specifications.

3.05 Diagnose heating system malfunctions.

STANDARD: Performed in allotted time determining if heating system is working properly.

NOTE: Job qualification performance standard - student can meet performance standards for 80% of tasks. Successful completion of Blocks 0.0, 3.0, and 9.0 required for job qualification as Heating and Air Conditioning Technician.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Braking System Maintenance and Repair (Block 4.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently part of
T & I No. 7393 - Automotive Mechanics II

Department of Community Colleges -
AUT 1121 - Braking Systems

INSTRUCTIONAL OBJECTIVES:

To provide the learner with occupational instruction to develop the skills and required related technical knowledge to qualify the learner to perform inspection, adjustment, and repair of automotive braking systems, according to manufacturer's specifications and meet industry standards.

QUALIFICATION OR JOB SKILLS GAINED:

With successful completion of this block of instruction, to include verification of qualification by performance evaluation, using industry performance standards, the learner is qualified as an Automotive Brakes Technician.

PREREQUISITES:

High Schools and post-secondary schools - Block 0.0 or evidence of adequate knowledge and experience regarding this block, to be verified by the successful completion of a demonstrated performance evaluation.

PERFORMANCE EVALUATION:

Test items (less specifics) for both written evaluation of related technical information and demonstrated performance evaluation for this block of instruction are attached or will be developed.

EQUIPMENT REQUIREMENTS:

General tool list attached to the last block of this program. Special equipment and tools list peculiar to this block is attached.

INSTRUCTIONAL CONTACT HOURS: High Schools: 60
CC/TI: 66

NOTE 1: Instructional time allocations for each instructional objective are suggested time only.
NOTE 2: Service manuals are considered as Related Technical Information.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

AUTOMOTIVE TECHNOLOGY

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair

TASK NUMBER: 4.01 TITLE: Adjust Brakes.

INSTRUCTIONAL OBJECTIVE - 4.01: How to Adjust Brakes.

SKILLS: (Process Objective)

4.011 - How to adjust brakes.

RELATED TECHNICAL INFORMATION:

See Parts Manual for parts identification.
Know theory of braking system.
See Manufacturers Specifications.

Required Instructional Time: 4.01, 2 hours.

Required Performance Standards:

4.011 - Flat rate + 20%. Brakes adjusted correctly according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.02 TITLE: Adjust Hand Brake Linkage.

INSTRUCTIONAL OBJECTIVE - 4.02: How to Adjust Hand Brake Linkage.

SKILLS: (Process Objective)

4.021 - How to adjust linkage.

RELATED TECHNICAL INFORMATION:

Know theory of parking brake.

Required Instructional Time: 4.02, 1 hour.

Required Performance Standards:

4.021 - Flat rate + 20%. Linkage adjusted correctly, according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.03 TITLE: Free Up Parking Brake Cables.

INSTRUCTIONAL OBJECTIVE - 4.03: How to Free Up Parking Brake Cables.

SKILLS: (Process Objective)

4.031 - How to free cables.

RELATED TECHNICAL INFORMATION:

Know how to free cables.
Causes of jammed parking brake cables.
Manufacturer's service manuals.

Required Instructional Time: 4.03, 1 hour.

Required Performance Standards:

4.031 - Time considered appropriate by instructor. Cables freed, operate according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.04 TITLE: Bleed Brakes.

INSTRUCTIONAL OBJECTIVE - 4.04: How to Bleed Brakes.

SKILLS: (Process Objective)

4.041 - How to bleed brakes.

RELATED TECHNICAL INFORMATION:

Know theory of braking system.

Required Instructional Time: 4.04, 6 hours.

Required Performance Standards:

4.041 - Flat rate + 20%. Follows manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair.

TASK NUMBER: 4.041 TITLE: Maintain and Service Brake Warning Systems.

INSTRUCTIONAL OBJECTIVE - 4.041: How to Maintain and Service Brake Warning Systems.

SKILLS: (Process Objectives)

How to:

4.0411 - Inspect and repair brake warning system units.
4.0412 - Reset brake warning light.

RELATED TECHNICAL INFORMATION:

- Theory of brake system.
- Service manuals.
- Manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TIME: 4.041, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student can identify and service brake warning system.
- Student can reset brake light on a variety of vehicles.
- Student can perform task in time limits considered adequate for job qualification by advisory and program committee, if no flat rate appropriate.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair

TASK NUMBER: 4.042 TITLE: Service Brake Metering Valves.

INSTRUCTIONAL OBJECTIVE - 4.042: How to Service Brake Metering Valves.

SKILLS: (Process Objectives)

How to:

4.0421 - Inspect and repair or replace metering or proportioning valve.
4.0422 - Adjust metering and proportioning valve.

RELATED TECHNICAL INFORMATION:

- Theory of brake system.
- Service manuals.
- Manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TIME: 4.042, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student can identify and service brake metering and proportioning valve according to manufacturer's specifications.
- Student can adjust brake metering and proportioning valve according to manufacturer's specifications.
- Student can perform task in time limits considered adequate for job qualification by advisory and program committee if no flat rate appropriate.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.05 TITLE: Inspect, Repair or Replace Self Adjusters.

INSTRUCTIONAL OBJECTIVE - 4.05: How to Inspect, Repair or Replace Self Adjusters.

SKILLS: (Process Objective)

4.051 - How to inspect and repair.

RELATED TECHNICAL INFORMATION:

Know theory of braking system.
See Manufacturers Specifications.

Required Instructional Time: 4.05, 4 hours.

Required Performance Standards:

4.051 - Flat rate + 20%. Brakes work.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'

TASK NUMBER: 4.06 TITLE: Replace Brake Hoses and Lines.

INSTRUCTIONAL OBJECTIVE - 4.06: How to Replace Brake Hoses and Lines.

SKILLS: (Process Objectives)

4.061 - How to perform visual inspection of brake hoses and lines.
4.062 - How to remove and replace brake hoses and lines.

RELATED TECHNICAL INFORMATION:

See Service Manual.

Required Instructional Time: 4.06, 2 hour.

Required Performance Standards:

4.061 - Time considered reasonable by instructor.
No leaks.
4.062 - Flat rate manual + 20%.
No leaks.
All holding brackets in place.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.071 TITLE: Inspect and Replace Brake Pads (Disc Brakes).

INSTRUCTIONAL OBJECTIVE - 4.071: How to Inspect and Replace Brake Pads (Disc Brakes).

SKILLS: (Process Objectives)

4.0711 - How to inspect brake pads.
4.0712 - How to replace disc brake pads.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 4.071, 6 hours.

Required Performance Standards:

4.0711 - Time considered reasonable by instructor. 1/16" in lining or less, replace lining.
4.0712 - Flat rate plus 20%. Brakes work. Uses proper tools.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.072 TITLE: Inspect and Replace Brake Shoes.

INSTRUCTIONAL OBJECTIVE - 4.072: How to Inspect and Replace Brake Shoes.

SKILLS: (Process Objectives)

4.0721 - How to inspect brake shoes.
4.0722 - How to remove and replace brake shoes.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 4.072, 6 hours.

Required Performance Standards:

4.0721 - Time considered reasonable by instructor. 1/16" in lining thickness or less, replace. Inspects for hydraulic leaks.
4.0722 - Flat rate + 20%. Uses proper tools. Brakes work.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.081 TITLE: Inspect and Turn Rotor If Necessary (Disc Brakes).

INSTRUCTIONAL OBJECTIVE - 4.081: How to Inspect and Turn Rotor If Necessary (Disc Brakes).

SKILLS: (Process Objectives)

4.0811 - How to make visual check of disc brake rotor.
4.0812 - How to use equipment to turn disc brake rotor.
4.0813 - How to use brake micrometer.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 4.081, 10 hours.

Required Performance Standards:

4.0811 - Time considered reasonable by instructor.
4.0812 - Uses equipment properly and in proper sequence.
Manufacturer's tolerances - 100%.
4.0813 - Manufacturer's specifications accuracy.
Time considered reasonable by instructor.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.082 TITLE: Inspect and Turn Brake Drums.

INSTRUCTIONAL OBJECTIVE - 4.082: How to Inspect and Turn Brake Drums.

SKILLS: (Process Objectives)

4.0821 - How to make visual check on brake drums.
4.0822 - How to inspect brake drums.
4.0823 - How to turn brake drums.

RELATED TECHNICAL INFORMATION:

See Manufacturers Specifications.

Required Instructional Time: 4.082, 8 hours.

Required Performance Standards:

4.0821 - Checks for grooves, foreign material.
4.0822 - Uses micrometer to measure to manufacturer's specifications for acceptability for use.
4.0823 - Uses proper equipment in proper sequence. Follows equipment manufacturer's specifications in turning drum.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair

TASK NUMBER: 4.083 TITLE: Radius Grind Brake Shoes.

INSTRUCTIONAL OBJECTIVE - 4.083: How to Radius Grind Brake Shoes.

SKILLS: (Process Objectives)

4.0831 - How to radius grind brake shoes.

RELATED TECHNICAL INFORMATION:

- Equipment manufacturer's operation manual.
- Manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TIME: 4.083, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student uses proper equipment. Follows manufacturer's specifications.
- Flat Rate plus 20% task performance time.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.09 TITLE: Repair or Replace Wheel Cylinder.

INSTRUCTIONAL OBJECTIVE - 4.09: How to Repair or Replace Wheel Cylinder.

SKILLS: (Process Objectives)

4.091 - How to make visual check on wheel cylinders.
4.092 - How to use wheel cylinder rebuild equipment.
4.093 - How to repair and replace wheel cylinders.

RELATED TECHNICAL INFORMATION:

Identify parts.
See Manufacturers Specifications.

Required Instructional Time: 4.09, 4 hours.

Required Performance Standards:

4.091 - Time considered reasonable by instructor, detects leaks.
4.092 - Time considered proper by instructor. Uses brake hone and correct tolerance gauge properly.
4.093 - Flat rate + 20%. Uses proper equipment in proper sequence.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.10 TITLE: Repair or Replace Master Cylinder.

INSTRUCTIONAL OBJECTIVE - 4.10: How to Repair or Replace Master Cylinder.

SKILLS: (Process Objectives)

4.101 - How to repair and replace brake master cylinder.
4.102 - How to make visual check on master cylinder.
4.103 - How to use master cylinder equipment.

RELATED TECHNICAL INFORMATION:

Identify parts.
See Manufacturers Specifications.

Required Instructional Time: 4.10, 4 hours.

Required Performance Standards:

4.101 - Uses proper cylinder hone. Uses correct tolerance gauge properly. No leaks. Checks brakes for proper operation.
4.102 - Detects leaks. Time considered reasonable by instructor.
4.103 - Uses cylinder hone and correct tolerance properly. Time limits: reasonable by instructor.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.)

TASK NUMBER: 4.11 TITLE: Repair or Replace Hydraulic Power Cylinders and Valves.

INSTRUCTIONAL OBJECTIVE - 4.11: How to Repair or Replace Hydraulic Power Cylinders and Valve

SKILLS: (Process Objectives)

4.111 - How to check booster system.
4.112 - How to repair and replace hydraulic power cylinders and valves.

RELATED TECHNICAL INFORMATION:

Know operation of booster system.

Required Instructional Time: 4.11, 4 hours.

Required Performance Standards:

4.111 - Checks for vacuum leaks. Checks for power assist. Time considered reasonable by instructor.
4.112 - Uses correct special tools properly. Test for operation and leaks. Time - flat rate + 20%. Brakes work.

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair (cont'd.

TASK NUMBER: 4.12 TITLE: Perform Operational Brake Inspections.

INSTRUCTIONAL OBJECTIVE - 4.12: How to Perform Operational Brake Inspections.

SKILLS: (Process Objectives)

4.121 - How to make visual check of brake system.
4.122 - How to make road test of brakes.
4.123 - How to check if vehicle meets braking specifications.

RELATED TECHNICAL INFORMATION:

Know if vehicle meets braking specifications.
State safety code standards.

Required Instructional Time: 4.12, 2 hours.

Required Performance Standards:

4.121 - Time considered reasonable by instructor. Checks for hydraulic and vacuum leaks, at all possible points.
4.122 - Checks for pull, noise and drag during road test. Time considered reasonable by instructor.
4.123 - Checks manufacturer's, Federal, and State specifications, using correct references for required stopping distances.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System Maintenance and Repair

- Brake spoon
- Drum micrometer
- Wheel cylinder hone
- Brake bleeding wrenches
- Brake bleeder (tank and adapters)
- Brake pliers (snap ring)
- Brake drum & rotor lathe with Radius Grinding Attachment.
- Caliper piston expander tool
- Wheel cylinder clip (clamp)
- Cylinder tolerance gauge
- Brake fluid dispenser
- Caliper piston extractor tool
- Tube flaring tool
- Grease and hub cap tool
- Tube bending tool
- Drum brake shoe adjustment gauge
- Tube cutting tool
- Bearing packing tool
- Brake shoe retracting spring installation and removal tool

TEST ITEMS

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System (cont'd.)

TASK

4.01 Describe brake operation. (written or oral) (performance Standard 80% accuracy)

a) As the brake pedal is depressed--

b) As the brake pedal is released--

The student should demonstrate the ability to perform the following jobs and meet job qualification performance standards: (manufacturer's specifications and flat rate plus 20%.)

TASKS	
4.082	Remove, inspect, and replace brake drums.
4.072	Remove and replace brake shoes.
4.09	Remove, recondition, and replace a wheel cylinder.
4.01	Adjust brake shoes.
4.04	Bleed the hydraulic system.
4.10	Remove, recondition, and replace a master cylinder.
4.02	Adjust hand brake linkage.
4.031	Free parking brake cable.
4.032	Replace hand brake linkage.
4.04	Bleed brakes.
4.05	Inspect, repair or replace self adjusters.
4.06	Replace brake hoses and lines.

TEST ITEMS (CON'T.)

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System

TASK

4.11 Repair or replace hydraulic power cylinders and valves.

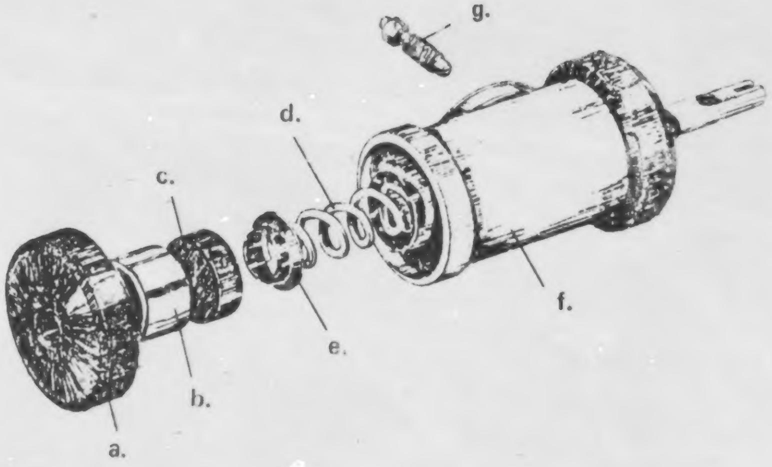
NOTE: Student must be able to meet required performance standards for at least 80% of the tasks of the block of instruction to be considered as occupationally qualified as a brake specialist.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System (cont'd.)

Identify the parts of a wheel cylinder, by letter, as shown below.

TASK 4.09



a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

f. ______________________

g. ______________________

NOTE 1: Performance Standard - 80% Accuracy

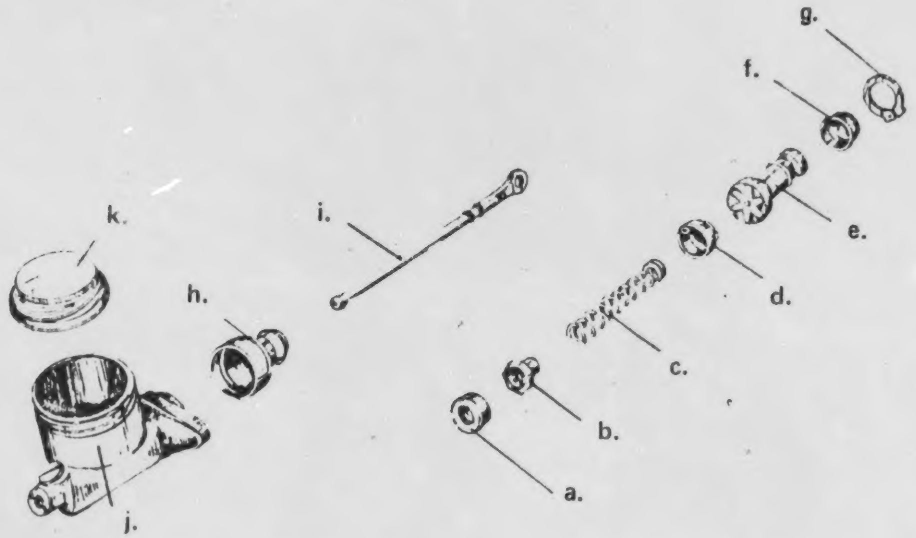
NOTE 2: An effort should be made to use the actual brake system components disassembled and displayed as shown above.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System

Identify the parts of the master cylinder shown below.

TASK 4.10



a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

k. ______________________________

NOTE 1: Performance Standard - 80% Accuracy

NOTE 2: An effort should be made to use the actual brake system components disassembled and displayed as shown above.

TEST ITEMS

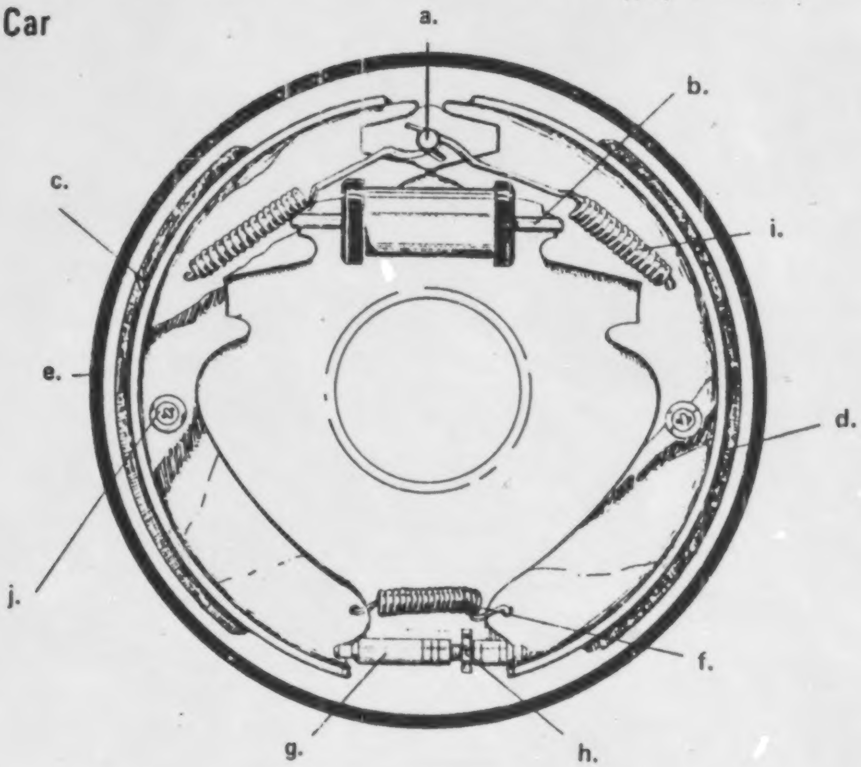
BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System (cont'd.)

Identify the parts of the brake assembly, by letter, as shown below.

Front of Car

←

TASK 4.12



a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

NOTE 1: Performance Standard - 80% Accuracy

NOTE 2: An effort should be made to use the actual brake system components disassembled and displayed as shown above.

TEST ANSWERS

BLOCK OR DIVISION NUMBER: 4.0 TITLE: Braking System

4.10 a. Rubber valve seat washer
- b. Check valve assembly
- c. Piston return spring
- d. Primary cup
- e. Piston
- f. Secondary cup
- g. Piston lock ring
- h. Boot
- i. Push rod
- j. Fluid reservoir
- k. Filler cap

4.09 a. Boot
- b. Piston
- c. Cup
- d. Spring
- e. Expander
- f. Cylinder housing
- g. Bleeder screw

4.12 a. Anchor pin
- b. Connecting links
- c. Primary brake shoe and lining
- d. Secondary brake shoe and lining
- e. Backing plate
- f. Adjusting screw spring
- g. Adjusting screw
- h. Star wheel
- i. Return springs
- j. Brake shoe retainers

4.01 Answer should contain the following points:

a) As the brake pedal is depressed, the master cylinder forces brake fluid through the check valve into the brake lines.

The fluid travels through the brake lines to the wheel cylinders.

The force of brake fluid by the master cylinder causes the wheel cylinder cups to move outward.

The movement caused by the wheel cylinder cups forces the brake shoe and lining to make contact with the brake drum.

The force of the fluid and the contact of the brake lining with the brake drum cause the vehicle to slow or stop.

b) As the brake pedal is released, the return springs pull the brake shoes back to the stop position, forcing the brake fluid to return to the master cylinder reservoir.

4.00 Demonstrated performance skills will be evaluated by the instructor to determine student ability to meet established performance standards.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(SDPI - High Schools - N/A)

COURSE: Fuel System Maintenance and Repair (Block 5.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently part of
T & I No. 7393 - Auto Mechanics III

Department of Community Colleges - Currently part of
DCC No. AUT 1102 - Engine Electrical & Fuel Systems.

INSTRUCTIONAL CONTACT HOURS: High Schools: 55
CC/TI: 55

INSTRUCTIONAL OBJECTIVES:

To provide the learner with the occupational instruction and the opportunity for practical work application to develop the skills and related technical knowledge necessary to qualify the learner to inspect, adjust, repair or replace, the components of the automotive fuel system, according to the manufacturer's specifications and to meet industry minimum performance standards.

QUALIFICATIONS OR JOB SKILLS GAINED:

Successful completion of this block of instruction qualifies the learner to perform inspections, adjustment, repair or replacement of components of the automotive fuel system. With validation of this qualification by performance evaluation, the successful learner is identified as an Automotive Fuel System Maintenance and Repair Specialist. This is a step in the development of the higher skilled Automotive Engine Repair Technician.

PREREQUISITES:

High Schools and post-secondary schools: Block 0.0 (Introduction to Automotive Technology) or evidence of knowledge based upon experience, verified by a demonstrated performance evaluation.

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance, but also include knowledge of related technical information. Test items are outline in nature and require specific data to complete the situation or problem, and relate directly to the instructional objectives.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program of instruction. Special equipment and tool requirements peculiar to this block are attached.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

Automotive Technology

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair

TASK NUMBER: 5.01 TITLE: Inspect, Service, or Replace Carburetor Air Cleaner.

INSTRUCTIONAL OBJECTIVE - 5.01: How to Inspect, Service, or Replace Carburetor Air Cleaner.

SKILLS: (Process Objectives)

5.011 - How to make visual inspection of carburetor air cleaner.
5.012 - How to service or replace carburetor air cleaner and PCV filter.

RELATED TECHNICAL INFORMATION:

- Know purpose and operation of carburetor air cleaner.
- See Manufacturer's Specifications.

Required Instructional Time: 5.01, 1 hour.

Required Performance Standards:

5.011 - Checks for cleanliness and replacement requirements according to manufacturer's specifications. Time considered reasonable by instructor.
5.012 - Follows manufacturer's specifications. Time considered reasonable by instructor.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair. (cont'd.)

TASK NUMBER: 5.02 TITLE: Clean or Replace Fuel Filter Units.

INSTRUCTIONAL OBJECTIVE - 5.02: How to Clean or Replace Fuel Filter Units.

SKILLS: (Process Objectives)

5.021 - How to make visual check of fuel filter.
5.022 - How to clean or replace a fuel filter.
5.023 - How to diagnose faulty fuel filter unit.

RELATED TECHNICAL INFORMATION:

- Know purpose and operation of fuel filter.
- Fuel contamination and effect on fuel system and engine.

Required Instructional Time: 5.02, 2 hours.

Required Performance Standards:

5.021 - Checks for fuel flow or sediment.
5.022 - Cleans or replaces fuel filter according to manufacturer's specifications.
Time considered reasonable by instructor.
5.023 - Follows equipment manufacturer's specifications.
Time considered reasonable by instructor.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.03 TITLE: Remove, Service, or Replace Fuel Pumps or Fuel Lines and Hoses.

INSTRUCTIONAL OBJECTIVE - 5.03: How to Remove, Service, or Replace Fuel Pumps or Fuel Lines and Hoses.

SKILLS: (Process Objectives)

5.031 - How to make visual inspection of fuel pump, lines, and hoses.
5.032 - How to use fuel system testers.
5.033 - How to remove and replace the fuel pump.

RELATED TECHNICAL INFORMATION:

- See parts manual for parts identification.
- See Manufacturer's Specifications.
- Fuel safety considerations.

Required Instructional Time: 5.03, 2 hours.

Required Performance Standards:

5.031 - Checks and detects leaks. Checks for hose condition. Time considered reasonable by instructor.
5.032 - Follows equipment manufacturer's specifications or instructions. Time considered reasonable by instructor.
5.033 - Flat Rate plus 20%, no leaks.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.04 TITLE: Install Carburetors.

INSTRUCTIONAL OBJECTIVE - 5.04: How to Install Carburetors.

SKILLS: (Process Objectives)

5.041 - How to remove and install carburetors.

RELATED TECHNICAL INFORMATION:

- See parts manual for parts identification.

Required Instructional Time: 5.04, 1 hour.

Required Performance Standards:

5.041 - Follows proper R & R sequence. Checks for fuel and air leaks. Installs linkage properly. Carburetor operates properly. Flat rate + 20% time.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.05 TITLE: Inspect and Measure Fuel Flow and Pressure of System.

INSTRUCTIONAL OBJECTIVE - 5.05: How to Inspect and Measure Fuel Flow and Pressure of System.

SKILLS: (Process Objectives)

5.051 - How to make visual inspection of fuel system.
5.052 - How to check fuel flow and pressure.

RELATED TECHNICAL INFORMATION:

See Manufacturer's Specifications.

Required Instructional Time: 5.05, 2 hours.

Required Performance Standards:

5.051 - Checks condition of fuel lines for leaks and detects leaks if present. Time considered reasonable by instructor.
5.052 - Follows test equipment manufacturer's specifications. Follows vehicle manufacturer's specifications. Time considered appropriate by instructor.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.06 TITLE: Adjust Carburetor.

INSTRUCTIONAL OBJECTIVE - 5.06: How to Adjust Carburetor.

SKILLS: (Process Objectives)

5.061 - How to adjust carburetors.
5.062 - How to use carburetor testers: 1) vacuum guage
2) tachometer
3) infrared
4) propane equipment

RELATED TECHNICAL INFORMATION:

- See Manufacturers Specifications.
- Meaning of readings on carburetor testers.

Required Instructional Time: 5.06, 7 hours.

Required Performance Standards:

5.061 - Follows manufacturer's specifications. Time considered reasonable by instructor.
5.062 - Follows equipment manufacturer's specifications. Time considered reasonable by instructor.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.07 TITLE: Inspect, Clean and Adjust Choke Unit (Automatic and Manual).

INSTRUCTIONAL OBJECTIVE - 5.07: How to Inspect, Clean and Adjust Choke Unit (Automatic and Manual).

SKILLS: (Process Objectives)

5.071 - How to make visual inspection of choke unit.
5.072 - How to clean and adjust choke unit.

RELATED TECHNICAL INFORMATION:

- See Manufacturers Specifications.

Required Instructional Time: 5.07, 2 hours.

Required Performance Standards:

5.071 - Checks choke cold for closure.
Checks freeness of movement of choke valve and linkage.
Time considered reasonable by instructor.
5.072 - Follows manufacturer's specifications.
Uses proper solvent and tools.
Time considered reasonable by instructor.
Choke closes freely.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.08 TITLE: Inspect, Service, or Replace Gas Tank, Cap and Sending Unit.

INSTRUCTIONAL OBJECTIVE - 5.08: How to Inspect, Service, or Replace Gas Tank, Cap and Sending Unit.

SKILLS: (Process Objectives)

5.081 - How to make visual inspection of gas tank, cap, and sending unit.
5.082 - How to service or replace gas tank, cap, and sending unit.

RELATED TECHNICAL INFORMATION:

- Safety considerations in fuel handling.
- Theory of electrical gauges.
- See Manufacturer's specifications.

Required Instructional Time: 5.08, 2 hours.

Required Performance Standards:

5.081 - Checks tank for leaks and detects leaks.
Checks cap for seal.
Checks sending unit by checking dash fuel gauge.
Time considered reasonable by instructor.
5.082 - Repair - replace gas tank - flat rate + 20%.
Repair - replace tank sending unit - flat rate + 20%.
Follows manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.09 TITLE: Repair or Service Carburetors.

INSTRUCTIONAL OBJECTIVE - 5.09: How to Repair or Service Carburetors.

SKILLS: (Process Objectives)

5.091 - How to diagnose and service carburetors.
5.092 - How to repair a carburetor.

RELATED TECHNICAL INFORMATION:

- Theory of carburetion.
- See parts manual for parts identification.
- See Manufacturer's Specifications.

Required Instructional Time: 5.09, 15 hours.

Required Performance Standards:

5.091 - Time considered reasonable by instructor.
5.092 - Repair & replace carburetor - flat rate + 20%.
Proper hook-up of connections.
Proper operation of engine.
No leaks.
As required by manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair (cont'd.)

TASK NUMBER: 5.10 TITLE: Analyze Fuel Injection Problems By Means of Electrical Diagnostic Equipment.

INSTRUCTIONAL OBJECTIVE - 5.10: How to Analyze Fuel Injection Problems By Means of Electrical Diagnostic Equipment.

SKILLS: (Process Objectives)

5.101 - How to make visual inspection of fuel injection system.
5.102 - How to use electrical diagnostic equipment to identify and diagnose fuel injection problems.

RELATED TECHNICAL INFORMATION:

- Theory of operation.
- See parts manual for parts identification.
- See Manufacturer's Specifications.

Required Instructional Time: 5.11, 7 hours.

Required Performance Standards:

5.101 - Follows inspection procedures in manufacturer's specifications and detects problems, if any. Time considered reasonable by instructor. (Approx. time: ________.)
5.102 - Uses diagnostic equipment according to manufacturer's specifications, and makes appropriate analysis with 80% accuracy. Time considered reasonable by instructor. (Approx. time: __________.)

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System Maintenance and Repair

Flaring tools
Carburetor gauge set
Vacuum-pressure gauge
Air-cleaner tester
Tachometer
Nut buster
Fuel injection diagnostic equipment
Infra-red tester
Steel tube cutting and bending tools
Propane Carburetor Kit

TEST ITEMS

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System

1. Match the carburetor system with statements of their use.

    a. ______________ Float System

    b. ______________ Idle System

    c. ______________ Main Metering System

    d. ______________ Power System

    e. ______________ Accelerator Pump System

    f. ______________ Choke System

    1. Provides fuel delivery during operation with the throttle partly to fully opened.
    2. Provides a richer mixture for cold engine starting and operation.
    3. Temporarily provides extra fuel necessary to overcome the leanness caused by rapid throttle opening.
    4. Maintains a given depth of fuel in the bowl assembly.
    5. Provides fuel delivery during closed throttle.
    6. Provides extra fuel for maximum engine power.

2. The student should demonstrate the ability to perform the following tasks and meet performance standards: (Selection of proper tools and equipment for task is included in the evaluation.)

TASK

5.01 Inspect, service, or replace carburetor air cleaner.

5.02 Clean or replace fuel filter units.

5.03 Remove, service, or replace fuel pumps or fuel lines and hoses.

5.04 Remove and replace carburetor.

5.05 Inspect and measure fuel flow and pressure of system.

5.06 Adjust carburetor.

5.07 Inspect, clean and adjust choke unit (automatic and manual).

5.08 Inspect, service, or replace gas tank, cap and sending unit.

5.09 Repair or service carburetors.

5.10 Repair or service exhaust emission control systems, to include manifold heat.

TEST ITEMS (Con't.)

BLOCK OR DIVISION NUMBER: 5.0 TITLE: Fuel System

TASK

5.11 Analyze fuel injection problems by means of electrical diagnostic equipment.

5.12 Perform operational inspections of exhaust emission control system.

TEST ANSWERS:

1. a. 4
   b. 5
   c. 1
   d. 6
   e. 3
   f. 2

2. Performance skills will be evaluated by the instructor or evaluation team. Manufacturer's specifications and flat rate plus 20% apply.

Note: Job qualification performance standard - 80% accuracy for other than applied performance test items. Student must be capable of meeting performance standards for at least 80% of the job tasks of this block (to include primary tasks) to be considered as job qualified as an Automotive Fuel System Maintenance and Repair Specialist.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Steering and Front End Maintenance and Repair (Block 6.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently part of T & I No. 7393- Automotive Mechanics III.

Department of Community Colleges - Currently part of AUT 1123 - Auto Chassis and Suspension.

INSTRUCTIONAL CONTACT HOURS: High Schools: None.
(This course or block of instruction is normally not taught at the high school level owing to a lack of instructional time and the complex equipment requirements.)

CC/TI: 220*
(*NOTE: Additional instructional time provided in Block 12.0 - Automotive Servicing.)

INSTRUCTIONAL OBJECTIVES:

To provide the learner with the necessary occupational instruction and opportunity for practical application to develop the skills and knowledge necessary to qualify the learner to inspect, maintain, adjust, repair, or replace the components of the automobile steering, front end, and suspension systems.

QUALIFICATIONS OR JOB SKILLS GAINED:

Successful completion of this block of instruction qualifies the learner to perform inspections, maintain, adjust, repair, or replace the components of the automobile steering, front end, and suspension system. With validation of this qualification by performance evaluation, using industry performance standards, the successful learner is considered to be qualified as an Automotive Front End Technician.

PREREQUISITES:

High Schools:	Not applicable.
Community College/ Technical Institute:	Block 0.0 (Introduction to Automotive Technology) or evidence of knowledge based upon experience, verified by a demonstrated performance evaluation.

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance, but also include a requirement for knowledge of related technical information. The test items are outline in nature and require specific data to complete the situation or problem, relate directly to the instructional objectives and are considered to be both valid and reliable.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program of instruction. Special equipment and tool requirements peculiar to this block are attached.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

Automotive

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair

TASK NUMBER: 6.01 TITLE: Lubricate the Front and Rear Suspension.

INSTRUCTIONAL OBJECTIVE - 6.01: How to Lubricate the Front and Rear Suspension.

SKILLS: (Process Objectives)

6.011 - How to lubricate front end.
6.012 - How to lubricate rear end.

RELATED TECHNICAL INFORMATION:

- Lubrication charts information.
- Manufacturer's specifications.

Required Instructional Time: 6.01, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

6.011 - Locates and cleans grease fittings, refers to lubrication charts and manufacturer's specifications.
- Installs fittings if required. Uses proper grease and grease gun.
- Removes excess grease on completion.
- Observes shop safety.

6.012 - Checks grease level in differential.
- Uses proper grease based on manufacturer's specifications.
- Observes shop safety.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'd.)

TASK NUMBER: 6.02 TITLE: Replace Belts and Set Tension.

INSTRUCTIONAL OBJECTIVE - 6.02: How to Replace Belts and Set Tension.

SKILLS: (Process Objectives)

6.021 - How to remove and replace and adjust power steering belts.
6.022 - How to diagnose power steering belts.

RELATED TECHNICAL INFORMATION:

- See parts manual for parts identification.
- Manufacturers specifications.

Required Instructional Time: 6.02, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

6.021 - Follows manufacturer's specifications for removal and replacement.
- Adjusts to proper tension.
- Uses proper tools.
- Performs task flat rate + 20% time.
- Observes shop safety.

6.022 - Follows procedures in manufacturer's specifications.
- Detects faulty belts if present.
- Observes shop safety.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair **(cont'd.)**

TASK NUMBER: 6.03 TITLE: Adjust Worm and Sector in Steering Box, Inspect Steering.

INSTRUCTIONAL OBJECTIVE - 6.03: How to Adjust Worm and Sector in Steering Box, Inspect Steering.

SKILLS: (Process Objectives)

6.031 - How to adjust worm and sector in steering box.
6.032 - How to inspect and diagnose worm and sector.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.

Required Instructional Time: 6.03, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

6.031 - Follows steps in manufacturer's specifications.
- Uses proper tools.
- Performs task flat rate + 20% time.
- Observes shop safety.

6.032 - Follows inspection procedures of manufacturer.
- Detects problem if present.
- Observes shop safety.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'

TASK NUMBER: 6.04 TITLE: Repair or Replace Manual Steering Components.

INSTRUCTIONAL OBJECTIVE - 6.04: How to Repair or Replace Manual Steering Components.

SKILLS: (Process Objectives)

6.041 - How to repair or replace manual steering components.
6.042 - How to inspect and diagnose manual steering components.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.04, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

6.041 - Follows manufacturer's specifications.
- Uses proper tools.
- Adjusts according to manufacturer's specifications.
- Observes shop safety.

6.042 - Follows inspection procedures in manufacturer's specifications.
- Detects problems if present.
- Observes shop safety.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'd.)

TASK NUMBER: 6.05 TITLE: Repair, Rebuild, or Replace Power Steering Components.

INSTRUCTIONAL OBJECTIVE - 6.05: How to Repair, Rebuild, or Replace Power Steering Components.

SKILLS: (Process Objectives)

6.051 - How to use special tools for power steering units.
6.052 - How to repair, rebuild, or replace power steering units.
6.053 - How to inspect and diagnose power steering components.

RELATED TECHNICAL INFORMATION:

- Manufacturers specification.
- See parts manual for parts identification.

Required Instructional Time: 6.05, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

6.051 - Uses tools according to the manufacturer's specifications.
- Performs task flat rate + 20% time.

6.052 - Uses manufacturer's specifications and technical manuals.
- Observes proper safety precautions.
- Performs task flat rate + 20% time.

6.053 - Through observation the student will inspect for leaks and check proper smooth operation of steering system to diagnose malfunctions or correct operation of system.
- Detects leaks if present.
- Performs task flat rate + 20% time.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (con

TASK NUMBER: 6.06 TITLE: Repair or Replace Tilt and Telescoping and Collapsible Mast Jackets.

INSTRUCTIONAL OBJECTIVE - 6.06: How to Repair or Replace Tilt and Telescoping and Collapsible Mast Jackets.

SKILLS: (process objectives)

6.061 - How to use special tools.
6.062 - How to repair, rebuild, or replace tilt and telescoping collapsible mast jackets.
6.063 - How to inspect and diagnose components of tilt and telescopic or collapsible mast jackets.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.06, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

6.061 - Uses tools according to the manufacturer's specifications (flat rate + 20%)
6.062 - Follows manufacturer's specifications to repair, rebuild, replace, inspect
& and check for proper operation. (Flat rate + 20%)
6.063 Component operates properly.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'd.

TASK NUMBER: 6.07 TITLE: Perform Visual Inspections of Suspension Systems.

INSTRUCTIONAL OBJECTIVE - 6.07: How to Perform Visual Inspections of Suspension Systems.

SKILLS: (Process Objectives)

6.071 - How to perform visual inspections of suspension systems.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- See parts manual for parts identification.
- Items to check during visual inspection.

Required Instructional Time: 6.07, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

6.071 - The student checks tires for clues of malfunction.
- Checks for wear in ball joints on king pins.
- Checks for wear in idler and steering arms.
- Checks for wear and adjustment of steering gear box.
- Makes correct diagnosis - flat rate + 20%.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont

TASK NUMBER: 6.08 TITLE: Replace Shock Absorbers and Mounting.

INSTRUCTIONAL OBJECTIVE - 6.08: How to Remove and Replace Shock Absorbers and Mountings.

SKILLS: (Process Objectives)

6.081 - How to remove and replace shock absorbers and mounting brackets.
6.082 - How to make visual inspections of shock absorbers.

RELATED TECHNICAL INFORMATION:

- Types of shock absorbers and characteristics.
- Manufacturers specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.08, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces shock absorbers and mounting brackets in flat rate + 20%.
- No noises from these components during operation of vehicle, follows manufacturer's specifications.
- Observes shop safety.

BLOCK OR DIVISION NUMBER: 6.0 **TITLE:** Steering and Front End Maintenance & Repair **(cont'd.)**

TASK NUMBER: 6.09 TITLE: Replace Front Wheel Bearings Grease Seal.

INSTRUCTIONAL OBJECTIVE - 6.09: How to Replace Front Wheel Bearings Grease Seal.

SKILLS: (Process Objectives)

6.091 - How to remove and replace front wheel bearing grease seals.
6.092 - How to inspect front wheel bearing grease seals.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- Characteristics of grease seals.

Required Instructional Time: 6.09, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects wheel bearing seals, wheel bearings and races for proper wear according to manufacturer's specifications.
- Detects faulty components.
- Performs task flat rate + 20% time.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont

TASK NUMBER: 6.10 TITLE: Repair or Replace Rear Suspension Systems.

INSTRUCTIONAL OBJECTIVE - 6.10: How to Repair or Replace Rear Suspension Systems.

SKILLS: (Process Objectives)

6.101 - How to repair or replace components of rear suspension system.
6.102 - How to make a visual inspection of rear suspension system.
6.103 - How to diagnose components of rear suspension and use equipment.

RELATED TECHNICAL INFORMATION:

- See parts manual for parts identification.
- Manufacturers specifications.
- Types and characteristics of suspension systems.

Required Instructional Time: 6.10, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

6.101 - Demonstrates the proper way to repair or replace the rear suspension system according to manufacturer's specifications.
- Performs task flat rate + 20%.

6.102 - Demonstrates proper method of making a visual inspection of the rear suspension system.
- Detects faults if any.
- Performs task flat rate + 20%.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'd.)

TASK NUMBER: 6.110 TITLE: Inspect and Repair Front Suspension Systems.

INSTRUCTIONAL OBJECTIVE - 6.110: How to Inspect and Repair Front Suspension Systems.

SKILLS: (Process Objectives)

6.1101 - How to repair or replace components of front suspension system.
6.1102 - How to make visual inspection of front end suspension system.
6.1103 - How to use equipment to diagnose components of front end suspension.

RELATED TECHNICAL INFORMATION:

- See parts manual for parts identification.
- See manufacturers specifications.
- Types and characteristics of front end suspension systems.

Required Instructional Time: 6.110, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont

TASK NUMBER: 6.111 TITLE: Replace Pivot Points on Steering Linkage.

INSTRUCTIONAL OBJECTIVE - 6.111: How to Replace Pivot Points on Steering Linkage.

SKILLS: (Process Objectives)

6.1111 - How to remove and replace pivot points on steering linkage.
6.1112 - How to make a visual inspection of pivot points.
6.1113 - How to use equipment to diagnose pivot points.

RELATED TECHNICAL INFORMATION:

- See parts manual for parts identification.
- See manufacturers specifications.

Required Instructional Time: 6.111, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

6.1111 - Follows manufacturer's specifications or technical manual for the removal or replacement of steering pivot points.
- Flat rate + 20%.
- Observes shop safety.

6.1112 - Makes visual check for looseness, wear or binding of pivot points.
- Detects faults if any.
- Flat rate + 20%.

6.1113 - Uses diagnostic equipment according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 6.0 **TITLE:** Steering and Front End Maintenance & Repair (cont'd.)

TASK NUMBER: 6.112 TITLE: Rebush King Pins.

INSTRUCTIONAL OBJECTIVE - 6.112: How to Rebush King Pins.

SKILLS: (Process Objectives)

6.1121 - How to rebush king pins.
6.1122 - How to make visual inspections of king pins.
6.1123 - How to use equipment to inspect king pins.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.112, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

- Makes visual inspection, reams to manufacturer's specifications and rebushes king pin, replaces assembly and checks for proper operation.
- Component operates properly.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'

TASK NUMBER: 6.113 TITLE: Replace Ball Joints.

INSTRUCTIONAL OBJECTIVE - 6.113: How to Replace Ball Joints.

SKILLS: (Process Objectives)

6.1131 - How to remove and replace ball joints.
6.1132 - How to use equipment to inspect ball joints.
6.1133 - How to make a visual inspection of ball joints.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.113, 16 hours.

REQUIRED PERFORMANCE STANDARDS:

6.1131 - Removes and replaces a ball joint according to manufacturer's specifications.
- Flat rate + 20%.
- Observes shop safety.

6.1132 - Makes a visual inspection of ball joint.
& - Flat rate + 20%.
6.1133 - Detects problem if any.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'd.

TASK NUMBER: 6.114 TITLE: Replace Front Suspension Control Arms and Bushings.

INSTRUCTIONAL OBJECTIVE - 6.114: How to Replace Front Suspension Control Arms and Bushings.

SKILLS: (Process Objectives)

6.1141 - How to remove and replace front suspension control arms and bushings.
6.1142 - How to use equipment to inspect front suspension control arms and bushings.
6.1143 - How to make visual inspection of front suspension control arms and bushings.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- Equipment manufacturers specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.114, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

6.1141 - Removes and replaces front suspension control arms and bushings according to manufacturer's specifications.
- Flat rate + 20%.

6.1142 - Uses proper equipment to inspect front suspension control arms and bushings.
- Flat rate + 20%.

6.1143 - Makes visual inspection of front suspension control arms and bushings.
- Detects evidence of problem.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont

TASK NUMBER: 6.115 TITLE: Adjust or Replace Torsion and Trunion Bars.

INSTRUCTIONAL OBJECTIVE - 6.115: How to Adjust or Replace Torsion and Trunion Bars.

SKILLS: (Process Objectives)

6.1151 - How to adjust or replace torsion and trunion bars.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.115, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Adjusts or replaces torsion and trunion bars according to manufacturer's specifications.
- Flat rate + 20%.
- Observes shop safety.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'd

TASK NUMBER: 6.12 TITLE: Balance Wheels and Tires.

INSTRUCTIONAL OBJECTIVE - 6.12: How to Balance Wheels and Tires.

SKILLS: (Process Objectives)

6.121 - How to balance wheels and tires.
6.122 - How to make visual checks of wheels and tires.
6.123 - How to use balancing equipment.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- Balancing equipment maintenance requirements.

Required Instructional Time: 6.12, 26 hours.

REQUIRED PERFORMANCE STANDARDS:

6.121 - Balances tires and wheels - 100% accuracy.
- Flat rate + 20%.

6.122 - Makes visual check of tires and wheels to determine improper wear.
- Detects problems if any.
- Flat rate + 20%.

6.123 - Uses balancing equipment according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'd

TASK NUMBER: 6.131 TITLE: Inspect, Adjust, and Repack Front Wheel Bearing.

INSTRUCTIONAL OBJECTIVE - 6.131: How to Inspect, Adjust, and Repack Front Wheel Bearings.

SKILLS: (Process Objectives)

6.1311 - How to inspect and adjust front wheel bearings.
6.1312 - How to repack front wheel bearings.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- See parts manual for parts identification.
- Wheel bearing grease characteristics.

Required Instructional Time: 6.131, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

6.1311 & 6.1312 - Inspects, repacks, and adjusts front wheel bearings according to manufacturer's specifications.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER. 6.0 TITLE: Steering and Front End Maintenance & Repair **(cont'd.)**

TASK NUMBER: 6.132 TITLE: Inspect and Replace Steering Spindles.

INSTRUCTIONAL OBJECTIVE - 6.132: How to Inspect and Replace Steering Spindles.

SKILLS: (Process Objectives)

6.1321 - How to replace wheel spindles.
6.1322 - How to inspect wheel spindles.
6.1323 - How to make visual inspections of wheel spindles.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- See parts manual for parts identification.

Required Instructional Time: 6.132, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects and replaces steering spindles according to manufacturer's **specifications.**
- Detects problems if any.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair (cont'

TASK NUMBER: 6.14 TITLE: Inspect and Align Front End.

INSTRUCTIONAL OBJECTIVE - 6.14: How to Inspect and Align Front End.

SKILLS: (Process Objectives)

6.141 - How to align front end.
6.142 - How to make visual check of front end.
6.143 - How to use equipment to make diagnosis of front end alignment.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- Equipment manufacturers specifications.
- Maintenance and requirements of alignment equipment.

Required Instructional Time: 6.14, 70 hours.

REQUIRED PERFORMANCE STANDARDS:

6.141 - Aligns front end according to manufacturer's specifications.
- Flat rate + 20%.

6.142 - Makes visual inspection of front end according to manufacturer's specifications.
- Detects problems if any.
- Flat rate + 20%.

6.143 - Uses diagnostic equipment according to manufacturer's specifications.
- Detects problem if any.
- Flat rate + 20%.
- Observes shop safety.

BLOCK OR DIVISION NUMBER: 6.0 **TITLE:** Steering and Front End Maintenance & Repair **(cont'd.)**

TASK NUMBER: 6.15 **TITLE:** Inspect and Align Rear End.

INSTRUCTIONAL OBJECTIVE - 6.15: How to Inspect and Align Rear End.

SKILLS: (Process Objectives)

6.151 - How to align rear end.
6.152 - How make visual check of rear end alignment.
6.153 - How to use equipment to make diagnosis of rear end alignment.

RELATED TECHNICAL INFORMATION:

- Manufacturers specifications.
- Equipment manufacturers specifications.

Required Instructional Time: 6.15, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Visually inspects and aligns rear end according to manufacturer's specifications.
- Detects problems if any.
- Flat rate + 20%.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance & Repair

Grease lubricator
Transmission grease gun
Belt tension gauge
Pittman arm puller
Crowsfoot (2)
Pressure gauge set
Special tools for rebuilding power steering components
Seal driver set
Bearing packer
Bushing driver set
Air chisel
Special sockets for ball joints
Steering wheel puller
4 ton hydraulic floor jack
King pin reamer set (optional)
Wheel balancer
Front end alignment machine and equipment
Power steering pump pulley puller
Tie rod remover and tie rod sleeve wrench
Inchpound wrench
Bench-holding fixture
Coil spring compressor tool
Ball joint removing tool
Control arm bushing tool set

TEST ITEMS

BLOCK OR DIVISION NUMBER: ,6.0 TITLE: Steering and Front End Maintenance and Repair

1. Match the following wheel alignment angles to statements of their purpose.

   a. _______ Camber

   b. _______ Caster

   c. _______ Toe-in

   d. _______ Toe-out on turns

   e. _______ Steering axis inclination

   1. To allow the inner front wheel to roll freely on turns and prevent the outer wheel from dragging.

   2. To aid steering stability and establish a pivot point about which the wheel can be easily turned.

   3. To enable the front wheels to maintain a straight-ahead position, or return to straight-ahead position after a turn has been completed.

   4. To compensate for varying tolerances in the steering linkage and to prevent excessive tire wear.

   5. To bring the road contact point of the tire more nearly under the point of load and eliminate excessive tire wear.

2. List five preliminary steps to wheel alignment.

   a.
   b.
   c.
   d.
   e.

NOTE: Manufacturer's specifications and flat rate plus 20% apply for all practical work performance standards.

TEST ITEMS PRACTICAL

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance and Repai

6.01 The student will clean fittings and lubricate the front and rear suspension systems. 100% accuracy.

6.02 The student will diagnose power steering belt problems, remove and replace and adjust power steering belts. 100% accuracy.

6.03 The student will inspect, diagnose and adjust worm and sector gear in the steering box. 100% accuracy.

6.04 The student will inspect, diagnose, and repair manual steering units and components, utilizing manufacturer's specifications. 100% accuracy.

6.05 1) Identify proper tools needed to repair the power steering system. 90% accuracy.

2) Student will explain the principle involved in the power steering system. 95% accuracy.

6.06 The student will demonstrate the use of special tools involved in the repair of most jacks. 95% accuracy.

6.07 The student will demonstrate the proper methods of visual inspection of the suspension system. 100% accuracy.

6.08 The student will demonstrate the proper installation of shock absorbers and mounting brackets. 100% accuracy.

6.09 The student will demonstrate the proper disassembly of a front wheel and clean, inspect, and replace as necessary the wheel bearing, its seal and races. 100% accuracy.

6.110 The student will demonstrate the proper method of disassembly and assembly of the rear suspension system. 100% accuracy.

6.111 The student will make a visual inspection, diagnose and repair pivot point problems. 100% accuracy.

6.112 The student will demonstrate the proper method of visual inspection rebushing and replacing king pin. 100% accuracy.

6.113 The student will visually inspect and demonstrate the proper removal and replacement of a ball joint. 100% accuracy.

6.114 The student will visually inspect and demonstrate the proper removal and replacement of the front suspension control arm and bushing. 100% accuracy.

6.115 The student will adjust and replace torsion and trunion bars utilizing manufacturer's specifications. 100% accuracy.

6.121 The student will properly balance wheels and tires. 100% accuracy.

6.131 The student will inspect, repack and adjust front wheel bearings. 100% accuracy.

TEST ITEMS (cont'd.)

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance and Repair

6.132 The student will inspect and replace steering spindles utilizing manufacturer's specifications. 100% accuracy.

6.141 The student will make a visual inspection of the front end and utilizing the proper equipment align the front end. 100% accuracy.

6.151 The student will visually inspect and align the rear end. 100% accuracy.

NOTE: Performance type test items are based on the premise that an automobile or the essential steering and front end components will be provided and that necessary tools and equipment are available. Selection of the proper tools and equipment and necessary preparation to perform the task are considered part of task performance. In evaluation of task performance, performance standards will include compliance with the manufacturer's specifications and application of the flat rate plus 20 % time limitations.

TEST ANSWERS

BLOCK OR DIVISION NUMBER: 6.0 TITLE: Steering and Front End Maintenance and Repair

1. a. 5
   b. 3
   c. 4
   d. 1
   e. 2

2. Any five of the following:

   a. Tire condition
   b. Tire pressure
   c. Wheel run-out
   d. Wheel bearings
   e. Front end looseness
   f. Shock absorbers
   g. Spring sag

NOTE: Job qualification performance standard for items 1 and 2 is 80% accuracy. Student must be capable of meeting performance standards for at least 80% of the job tasks of this block (to include primary tasks) to be considered as job qualified as an Automotive Front End Technician.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Drive Train and Manual Transmission Maintenance and Repair (Block 7.0)*

COURSE DESCRIPTION: Department of Public Instruction - Currently part of T & I No. 7393- Automotive Mechanics III.

Department of Community Colleges - Currently part of AUT 1124 - Auto Power Train Systems.

INSTRUCTIONAL CONTACT HOURS: High Schools: 165
CC/TI: 165

INSTRUCTIONAL OBJECTIVES:

To provide the learner with the occupational instruction and the opportunity for practical work application to develop the skills and related technical knowledge necessary to qualify the learner to inspect, adjust, service, repair or replace, the components of the automotive power train with a manual transmission, according to the manufacturer's specifications and to meet industry minimum performance standards.

QUALIFICATIONS OR JOB SKILLS GAINED:

Successful completion of this block of instruction qualifies the learner to perform inspections, make adjustments, service, repair or replace the components of the automotive power train with a manual transmission. With validation of this qualification by performance evaluation, the successful learner is qualified as an Automotive Manual Transmission and Rear Axle Technician.

PREREQUISITES:

High Schools and post-secondary schools: Block 0.0 (Introduction to Automotive Technology) or evidence of knowledge based upon experience, verified by a demonstrated performance evaluation.

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance, but also include knowledge of related technical information. Test items are outline in nature and require specific data to complete the situation or problem, and relate directly to the instructional objectives.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program of instruction. Special equipment and tool requirements peculiar to this block are attached.

*NOTE: This title applies to all instructional objective pages in this block.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

Automotive Technology

BLOCK OR DIVISION NUMBER: 7.0 TITLE: ~~Power~~ Train and Manual Transmission

TASK NUMBER: 7.01 TITLE: Lubricate U-joints.

INSTRUCTIONAL OBJECTIVE - 7.01: How to Lubricate U-Joints.

SKILLS: (Process Objectives)

7.011 - How to make visual checks of U-joints.
7.012 - How to use lubrication equipment.
7.013 - How to lubricate U-joints.

RELATED TECHNICAL INFORMATION:

See manufacturer's specifications - What are U-joint danger signs?

REQUIRED INSTRUCTIONAL TIME: 7.01, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

7.011 - Lubricates U-joints according to specifications, using proper lubricant.
7.012 - Uses lubrication equipment properly according to manufacturer's specifications. Uses equipment safely.
7.013 - Makes visual check of U-joint. Demonstrates ability to determine if U-joint is defective or not.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.02 TITLE: Lubricate Speedometer Cable Drive Gear and Housing.

INSTRUCTIONAL OBJECTIVE - 7.02: How to Lubricate Speedometer Cable Drive Gear and Housing.

SKILLS: (Process Objectives)

7.021 - How to remove speedometer cable and drive gear.
7.022 - How to lubricate speedometer cable drive gear and housing.
7.023 - How to make visual check for cable fray and wear.

RELATED TECHNICAL INFORMATION:

See manufacturer's specifications, see parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 7.02, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes speedometer cable and drive gear properly.
- Checks cable for fray and wear.
- Ensures that speedometer unit works properly.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 7.0 **TITLE:** Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.03 **TITLE:** Remove and Replace Slip-Joints or U-Joints.

INSTRUCTIONAL OBJECTIVE - 7.03: How to Remove and Replace Slip-Joints or U-Joints.

SKILLS: (Process Objectives)

7.031 - How to remove and replace slip-joints and U-joints:
using special tools.
7.032 - using standard tools.
7.033 - How to make visual check diagnosis of slip-joints and U-joints for proper operation.
7.034 - How to mount U-joint to place grease fitting in proper position.

RELATED TECHNICAL INFORMATION:

See parts manual for parts identification.
Know proper position of grease fitting.
Know standards for satisfactory and unsatisfactory U-joints.

REQUIRED INSTRUCTIONAL TIME: 7.03, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

7.031 - Removes and replaces slip joints and U-joints using standard and special tools properly. Flat rate + 20%.
7.032 - Diagnoses slip-joint assuring proper operation.
7.033 - Mounts U-joint and places grease fitting in proper position. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.04 TITLE: Replace Drive-Line Seals.

INSTRUCTIONAL OBJECTIVE - 7.04: How to Replace Drive-Line Seals.

SKILLS: (Process Objectives)

7.041 - How to make visual inspection of drive-line seals.
7.042 - How to remove and replace in-put shaft seal.
7.043 - How to remove and replace rear extension housing seal.
7.044 - How to replace differential pinion seal.
7.045 - How to remove and replace rear axle seals.

RELATED TECHNICAL INFORMATION:

See parts manual for parts identification.
Know causes of seal failures - symptoms
- Input Shaft Seal
- Rear Extension Housing Seal
- Differential Pinion Seal
- Rear Axle Seals

REQUIRED INSTRUCTIONAL TIME: 7.04, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

7.041 - Determines if seals are faulty.
7.042 - Removes and replaces all drive line seals properly according to manufacturer's specifications with no leaks. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.05 TITLE: Test and Replace Out-of-Round Drive Shaft.

INSTRUCTIONAL OBJECTIVE - 7.05: How to Test and Replace Out-of-Round Drive Shaft.

SKILLS: (Process Objectives)

7.051 - How to make visual inspection of out-of-round drive shaft.
7.052 - How to use proper equipment to check drive shaft out-of-round.
7.053 - How to remove and replace drive shaft.

RELATED TECHNICAL INFORMATION:

See manufacturer's specifications.
See parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 7.05, 3 hours.

REQUIRED PERFORMANCE STANDARDS:

7.051 - Checks and determines out-of-round drive shaft using proper equipment.
7.052 - Replaces defective drive shaft. Flat rate + 20% assuring proper alignment.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.06 TITLE: Inspect Drive Shafts, U-Joints and Center Bearing.

INSTRUCTIONAL OBJECTIVE - 7.06: How to Inspect Drive Shafts, U-Joints, and Center Bearing.

SKILLS: (Process Objectives)

7.061 - How to make visual inspection of center support bearing.
7.062 - How to remove and replace center support bearing.

RELATED TECHNICAL INFORMATION:

See manufacturer's specifications.
See parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 7.06, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

7.061 - Inspects center support bearing to determine proper operation.
7.062 - Removes and replaces center support bearing to vehicle standards. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.07 TITLE: Replace Manual Transmission Gaskets and Seals (In-Car Repairs).

Deleted - Covered in 7.04

TASK NUMBER: 7.08 TITLE: Replace Pilot Bearings.

INSTRUCTIONAL OBJECTIVE - 7.08: How to Replace Pilot Bearings.

SKILLS: (Process Objectives)

7.081 - How to diagnose pilot bearing for malfunction.
7.082 - How to remove and replace pilot bearing.
7.083 - How to make visual inspection for tolerance.

RELATED TECHNICAL INFORMATION:

See parts manual for parts identification.
See service manual.

REQUIRED INSTRUCTIONAL TIME: 7.08, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

7.081 - Determines if pilot bearing is working properly according to specifications.
7.082 - Removes and replaces pilot bearing properly, assuring proper operation. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.09 TITLE: Replace Release Bearings.

INSTRUCTIONAL OBJECTIVE - 7.09: How to Replace Release Bearings.

SKILLS: (Process Objectives)

7.091 - How to remove and replace release bearings.
7.092 - How to diagnose release bearing failure - visual.

RELATED TECHNICAL INFORMATION:

See parts manual, for parts identification.

REQUIRED INSTRUCTIONAL TIME: 7.09, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

7.091 - Determines if release bearing is working properly according to specifications.
7.092 - Replaces release bearing, adjusts clutch to assure proper operation. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.10 TITLE: Replace Transmission Mounts.

INSTRUCTIONAL OBJECTIVE - 7.10: How to Replace Transmission Mounts.

SKILLS: (Process Objectives)

7.101 - How to make visual inspection of transmission mounts.
7.102 - How to remove and replace transmission mounts.
7.103 - How to use transmission jacks.

RELATED TECHNICAL INFORMATION:

See parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 7.10, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

7.101 - Makes visual inspection to determine if transmission mount is defective. Detects problem if present with 80% accuracy.
7.102 - Replaces defective mount to vehicle standards. Flat rate + 20%. Uses transmission jack properly and with adequate safety precautions.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.11 TITLE: Adjust Mechanical-Type Clutch.

INSTRUCTIONAL OBJECTIVE - 7.11: How to Adjust Mechanical-Type Clutch.

SKILLS: (Process Objectives)

7.111 - How to adjust mechanical-type clutches.
7.112 - How to diagnose proper adjustments.

RELATED TECHNICAL INFORMATION:

See manufacturer's specifications.
See parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 7.11, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

7.111 - Diagnoses clutch for proper operation.
7.112 - Adjusts clutch to manufacturer's specifications. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.12 TITLE: Adjust External Shift Linkage on Manual Transmission.

INSTRUCTIONAL OBJECTIVE - 7.12: How to Adjust External Shift Linkage on Manual Transmissions.

SKILLS: (Process Objectives)

7.121 - How to adjust shift linkage on manual transmissions.
7.122 - How to make visual check of shift linkage.

RELATED TECHNICAL INFORMATION:

See manufacturer's specifications.
See parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 7.12, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

7.121 - Adjusts shift linkage to manufacturer's specifications so unit works effectively.
7.122 - Makes visual inspection to determine if shift linkage is worn or defective and detects problem if present with 80% accuracy.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.13 TITLE: Inspect Shifting.

INSTRUCTIONAL OBJECTIVE - 7.13: How to Inspect Shifting.

SKILLS: (Process Objectives)

7.131 - How to make a road test.
7.132 - How to make a visual check.
7.133 - How to make a diagnosis of components.

RELATED TECHNICAL INFORMATION:

Items to be checked in a road test.
What to look for on a visual inspection.

REQUIRED INSTRUCTIONAL TIME: 7.13, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

7.131 - Performs road test to determine if unit is shifting properly.
7.132 - Makes visual check for worn or defective parts. Detects problem if present - 80% accuracy.
7.133 - Makes diagnosis of all components for proper adjustment and operation. Runs proper test as part of diagnosis.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.14 TITLE: Perform Operational Manual Transmission Inspections.

INSTRUCTIONAL OBJECTIVE - 7.14: How to Perform Operational Manual Transmission Inspections.

SKILLS: (Process Objectives)

7.141 - How to perform operational inspections.
7.142 - How to make manual transmission road test.
7.143 - How to make visual check of manual transmission.

RELATED TECHNICAL INFORMATION:

Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 7.14, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Transmission shifts properly.
- Transmission shifts properly with no noise.
- No leaks, linkage tight, all rubber grommets and/or washers in place.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.15 TITLE: Replace Mechanical-Type Clutch.

INSTRUCTIONAL OBJECTIVE - 7.15: How to Replace Mechanical-Type Clutch.

SKILLS: (Process Objectives)

7.151 - How to replace mechanical-type clutch.
7.152 - How to diagnose mechanical-type clutch components.
7.153 - How to make visual check of mechanical clutch.
7.154 - How to use special tools and equipment to replace mechanical clutch.

RELATED TECHNICAL INFORMATION:

Special tool requirements.
Manufacturer's specifications.
Parts manual.

REQUIRED INSTRUCTIONAL TIME: 7.15, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Clutch and pressure plate installed correctly - free play within specifications. All bolts, pans, and pins in place - flat rate + 20%.
- Learner able to detect noise, slip or chatter.
- All bolts, pans and pins in place - free play of clutch within specifications.
- Uses clutch alignment tool correctly.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.16 TITLE: Remove and Replace A Manual Transmission.

INSTRUCTIONAL OBJECTIVE - 7.16: How to Remove and Replace A Manual Transmission.

SKILLS: (Process Objectives)

7.161 - How to remove and replace a manual transmission.
7.162 - How to make a visual check of a manual transmission.

REQUIRED TECHNICAL INFORMATION:

Safety requirements.
Special tools and equipment.
Manufacturer's specifications.
Parts manual.

REQUIRED INSTRUCTIONAL TIME: 7.16, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Transmission installed correctly - drive shaft, all bolts, pins, and washers in place - flat rate + 20%.
- No leaks, linkage tight, all rubber grommets and/or washers in place.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.17 TITLE: Rebuild A Manual Transmission.

INSTRUCTIONAL OBJECTIVE - 7.17: How to Rebuild A Manual Transmission.

SKILLS: (Process Objectives)

7.171 - How to use special tools in transmission rebuild.
7.172 - How to rebuild a manual transmission.
7.173 - How to make a diagnosis of components.
7.174 - How to make a visual check of transmission components.
7.175 - How to make a road test of manual transmission.

RELATED TECHNICAL INFORMATION:

Parts manual.
Manufacturer's specifications.
Special tool requirements.

REQUIRED INSTRUCTIONAL TIME: 7.17, 45 hours.

REQUIRED PERFORMANCE STANDARDS:

- Demonstrates ability to use special tools used in transmission overhaul.
- Transmission components installed correctly.
- Transmission shifts properly - flat rate + 20%.
- Learner demonstrates an ability to recognize defective and/or broken parts.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.18 TITLE: Rebuild Over-Drive Unit.

INSTRUCTIONAL OBJECTIVE - 7.18: How to Rebuild Over-Drive Unit.

SKILLS: (Process Objectives)

7.181 - How to use required special tools and equipment.
7.182 - How to diagnose over-drive unit components.
7.183 - How to rebuild over-drive units.
7.184 - How to make visual checks of over-drive units.
7.185 - How to road test over-drive units.

RELATED TECHNICAL INFORMATION:

Special tool requirements.
Parts manual.
Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 7.18, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Learner demonstrates ability to use special tools required in overdrive overhaul.
- Learner demonstrates ability to recognize defective overdrive components.
- Flat rate + 20%, overdrive components installed correctly.
- Overdrive works properly.
- All wires and bolts in place.
- Overdrive works properly, with no noise and no leaks.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.19 TITLE: Replace Rear-Axle Shaft, Bearings, and Seals.

INSTRUCTIONAL OBJECTIVE - 7.19: How to Replace Rear-Axle Shaft, Bearings, and Seals.

SKILLS: (Process Objectives)

7.191 - How to use required special tools and equipment.
7.192 - How to remove and replace rear-axle shaft, bearings, and seals.
7.193 - How to make visual check.
7.194 - How to make a diagnosis of rear-axle shaft, bearings, and seals.
7.195 - How to road test.

RELATED TECHNICAL INFORMATION:

Special tool and equipment requirements.
Parts manual.
Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 7.19, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Learner demonstrates ability to use hydraulic press, bearing pullers, and other special equipment used in rear axle bearing replacement.
- No leaks or noise. All bolts and lines in place and tightened to specifications. Bearing and/or seal installed correctly.
- Flat rate + 20%.
- No leaks.
- Learner demonstrates ability to isolate rear bearing and/or seal trouble.
- Learner demonstrates ability to diagnose rear-axle troubles during road test.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.20 TITLE: Remove and Replace Pinion Seal.

INSTRUCTIONAL OBJECTIVE - 7.20: How to Remove and Replace Pinion Seal.

SKILLS: (Process Objectives)

7.201 - How to use special equipment.
7.202 - How to remove and replace pinion seal.
7.203 - How to make visual check.
7.204 - How to diagnose components of pinion seal.

RELATED TECHNICAL INFORMATION:

Special tool requirements.
Parts manual.
Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 7.20, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Learner demonstrates ability to use special tools and equipment used in pinion seal replacement.
- Installed properly with no leaks.
- Flat rate + 20%.
- Learner demonstrates ability to tell when pinion seal is leaking.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.21 TITLE: Remove and Replace Differentials.

INSTRUCTIONAL OBJECTIVE - 7.21: How to Remove and Replace Differentials.

SKILLS: (Process Objectives)

7.211 - How to remove and replace differentials.
7.212 - How to make visual check of differentials.
7.213 - How to diagnose components of differentials.

RELATED TECHNICAL INFORMATION:

Safety considerations.
Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 7.21, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Learner demonstrates ability to remove and replace differential with all components installed and working properly, according to manufacturer's specifications.
- Flat rate + 20%.
- Learner demonstrates ability to visually check and detect differential leaks or broken/faulty components.
- Learner demonstrates ability to recognize defective and/or broken components.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.22 TITLE: Overhaul Differentials.

INSTRUCTIONAL OBJECTIVE - 7.22: How to Overhaul Differentials.

SKILLS: (Process Objectives)

7.221 - How to use special tools and equipment.
7.222 - How to overhaul differentials.
7.223 - How to make visual check of differentials. (See 7.212)
7.224 - How to road test differentials and what to look for. (See 7.241)

RELATED TECHNICAL INFORMATION:

Special tool and equipment requirements.
Parts manual.
Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 7.22, 20 hours.

REQUIRED PERFORMANCE STANDARDS:

- Learner demonstrates ability to overhaul differential and make all checks and mearurement.
- All bolts and lines installed to specifications.
- Differential works properly, no noise.
- Learner demonstrates ability to visually check and detect differential leaks or broken/faulty components.
- Flat rate + 20%.
- Demonstrates ability to road test differentials for proper operation and/or noise.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.23 TITLE: Perform Operational Inspections of Differentials.

INSTRUCTIONAL OBJECTIVE - 7.23: How to Perform Operational Inspections of Differentials.

SKILLS: (Process Objectives)

7.231 - How to make visual check of differentials (See 7.212 and 7.223).
7.232 - How to perform operational inspection of differentials.
7.233 - How to road test (See 7.241).

RELATED TECHNICAL INFORMATION:

Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 7.23, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Learner demonstrates ability to visually check and detect differential leaks or broken/faulty components.
- Demonstrates ability to road test differentials for proper operation and/or noise.

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (cont'd.)

TASK NUMBER: 7.24 TITLE: Road Test Inspections of Differentials.

INSTRUCTIONAL OBJECTIVE - 7.24: How to Make Road Test Inspections of Differentials.

SKILLS: (Process Objectives)

7.241 - How to make a road test of differentials and what to look for.

RELATED TECHNICAL INFORMATION:

Differential problems and their indicators.
Manufacturer's specifications.
Causes of differential malfunctions.

REQUIRED INSTRUCTIONAL TIME: 7.24, 1 hour.

REQUIRED PERFORMANCE STANDARDS:

- Demonstrates ability to road test differentials for proper operation and/or noise.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train & Manual Transmission Maintenance and Repair

Pressure grease gun
Transmission grease gun
Special driveshaft tools
Seal driver set
Dial indicator set
Seal Puller Set
Clutch alignment tool
Special tools for overhauling manual transmission
Special tools for overhauling differentials
Pins for linkage adjustment
Universal joint removal and installation tool
Shift linkage grommet tool
Output shaft bearing remover/installer
Brake cylinder hone for clutch master cylinder and slave cylinder
Differential bearing adjusting nut wrench universal
Pinion flange holder
Pinion flange puller
Torque wrench
Hydraulic Press

TEST ITEMS

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (Drive Lines)

The following test items are normal tasks required for job qualification. Job performance testing will be based on the assumption that a vehicle is available or the power train and manual transmission assembly mounted on the frame for instructional purposes. Selection of the proper tools, equipment, and material required for task performance and the correct use of such items should be considered in performance evaluation. Performance standards must include compliance with manufacturer's specifications and application of the flat rate plus 20% time limitations.

Student must be capable of meeting task performance standards for at least 80% of the job tasks of this block (must include primary tasks) to be considered as job qualified as an Automotive Manual Transmission and Rear Axle Technician.

TASK

7.02 Lubricate speedometer cable drive gear and housing.

7.04 Replace drive-line seals.

7.06 Inspect drive shafts, U-joints and center bearing.

7.07 Replace manual transmission gaskets and seals (in-car repairs).

7.10 Replace transmission mounts.

7.13 Inspect shifting.

7.14 Perform operational manual transmission inspections.

7.16 Replace manual transmission.

7.17 Rebuild manual transmission (major repairs).

7.18 Rebuild overdrive unit.

7.19 Replace rear-axle shaft, bearings and seal.

7.20 Replace pinion seal.

7.21 Replace differentials.

7.22 Overhaul differential.

7.23 Perform operational inspections of differentials.

7.24 Road test inspections of differentials.

TEST ITEMS

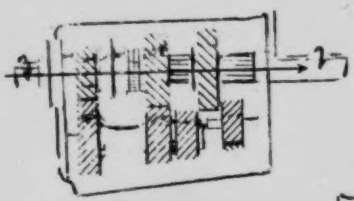
BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (Standard Transmission)

TASKS:

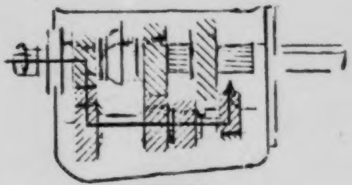
7.12
7.13
7.14
7.16
7.17
7.18

1. Select and circle the gear that each of the following transmissions are positioned in.

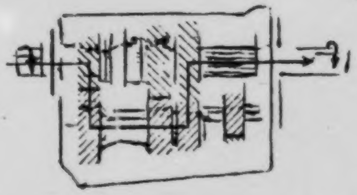
a. (1) neutral
(2) first
(3) second
(4) third
(5) reverse



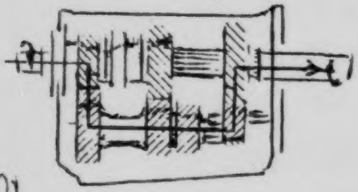
b. (1) neutral
(2) first
(3) second
(4) third
(5) reverse



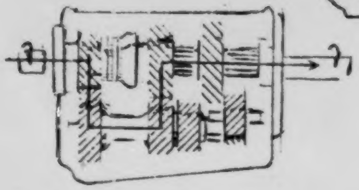
c. (1) neutral
(2) first
(3) second
(4) third
(5) reverse



d. (1) neutral
(2) first
(3) second
(4) third
(5) reverse



e. (1) neutral
(2) first
(3) second
(4) third
(5) reverse



2. The student should demonstrate the ability to perform the following jobs to meet job qualification performance standards:

a. Remove and replace a standard transmission.
b. Disassemble, inspect, and reassemble a three-speed transmission.

TEST ANSWERS:

1. a. 4
b. 1
c. 2
d. 5
e. 3

2. Demonstrated performance skills will be evaluated by the instructor to determine student ability to meet established performance standards. Manufacturer's specifications and flat rate plus 20% apply.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (Clutch)

TASKS:

7.08 1. List two methods used to actuate clutch release.
7.09
7.11 a.
7.12 b.
7.15

2. List and describe the mechanisms used on a clutch disc to facilitate smooth operation.

   a.

   b.

3. The student should demonstrate the ability to perform the following jobs and meet established job qualification performance standards.

   a. Remove clutch assembly.
   b. Inspect clutch assembly.
   c. Replace clutch assembly.
   d. Adjust clutch free travel.

TEST ANSWERS:

1. a. Linkage and rods from pedal to release yoke
   b. Hydraulic

2. a. Cushioning device--Thin waved cushion spring between clutch facing.
   b. Dampening device--Series of heavy coil springs placed in the clutch disc hub to absorb shock.

3. Demonstrated performance skills will be evaluated by the instructor to determine student ability to meet established performance standards. Manufacturer's specifications and flat rate plus 20% apply.

TASK

7.00 The student should demonstrate the ability to perform the following jobs and meet job qualification performance standards:

7.05 Remove and replace a propeller shaft.

7.03 Remove and replace a cross and roller universal joint.

Note: Selection of proper tools for job may be included as part of testing in any of above items.

TEST ANSWERS

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (Drive Lines)

7.03 Cross and Roller U-Joint

a. Yoke
b. Cross
c. Rollers
d. Needle Bearings
e. Seal
f. Snap Ring

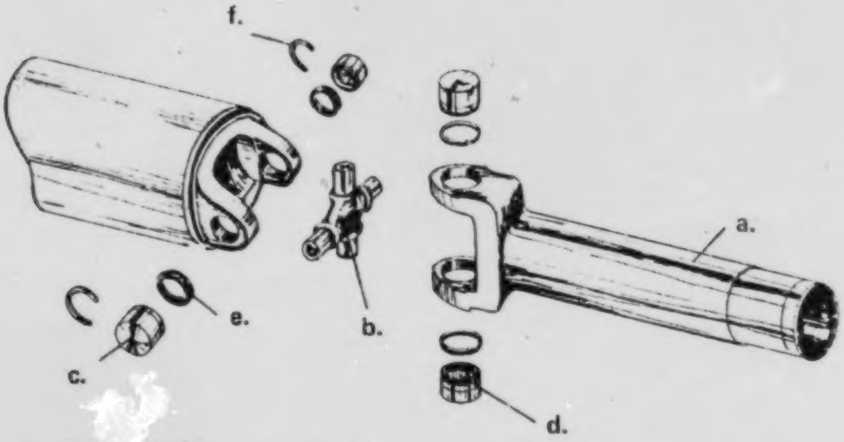
7.00 Demonstrated skills will be evaluated by the instructor to determine student ability to meet established performance standards. Manufacturer's specifications and flat rate plus 20% apply.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 7.0 TITLE: Power Train and Manual Transmission (Drive Lines)

TASKS:

7.01
7.03 Identify the parts to the following drawing of a Cross and Roller U-Joint.



a. ______________________

b. ______________________

c. ______________________

d. ______________________

e. ______________________

f. ______________________

NOTE 1: Performance Standard - 80% Accuracy

NOTE 2: An effort should be made to use the actual U-Joint components disassembled and displayed as shown above.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Automotive Engine - Maintenance, Repair, and Overhaul (Block 8.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently part of T & I No. 7392 & 7393 - Automotive Mechanics II & III and T I & No. 7403 - Auto Engine Tune-Up III.
Department of Community Colleges - Currently part of AUT 1101 - Internal Combustion Engines.

INSTRUCTIONAL CONTACT HOURS: High Schools: 220
CC/TI: 176*
(*NOTE: Additional instructional time provided Block 12.0--Automotive Servicing)

INSTRUCTIONAL OBJECTIVES:

To provide the learner with the occupational instruction and opportunity for practical work application to develop the skills and related technical knowledge to qualify the learner to inspect, maintain, repair, replace, and overhaul the automotive gasoline engine, less the electrical and fuel systems, according to the manufacturer's specifications and to meet the industry minimum performance standards. (NOTE: Instructional time and skill development for the electrical & carburation systems are provided in Block 11.0 - Automotive Electrical System and Block 5.0 - Fuel System Maintenance and Repair. The cooling system is covered in Block 2.0 - Cooling System Maintenance and Repair.)

QUALIFICATIONS OR JOB SKILLS GAINED:

Successful completion of this block of instruction qualifies the learner to perform inspections, make adjustments, service, repair, replace, and overhaul the automotive gasoline engine, less the engine electrical and fuel systems, with validation of this qualification by performance evaluation, the learner is qualified as an Automotive Engine Repairman. With successful completion of Block 1.0 (Lubrication), Block 2.0 (Cooling System), Block 5.0 (Fuel System), and the ignition system portion of Block 11.0 (Electrical System), plus this block (8.0), the learner is then qualified as an Automotive Engine Repair Technician.

PREREQUISITES:

High Schools and post-secondary schools: Successful completion of Block 0.0 (Introduction to Automotive Technology), Block 2.0 (Cooling System Maintenance and Repair), or successful completion of a performance evaluation, based upon evidence of previous occupational experience.

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance, but also include requirements for knowledge of related technical information. Test items are outline in format and for the most part require specific data to complete the situation or problem to make a complete test item. All test items relate to the instructional objectives and are considered to be both valid and reliable.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program of instruction. Special equipment and tool requirements peculiar to this block are attached.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

Automotive

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul

TASK NUMBER: 8.01 TITLE: Clean Engines.

INSTRUCTIONAL OBJECTIVE - 8.01: How to Clean Engines.

SKILLS: (Process Objectives)

8.011 - How to properly clean an engine.

RELATED TECHNICAL INFORMATION:

- Use and maintenance of cleaning equipment.
- Safety precautions involved.
- Use of solvents.

REQUIRED INSTRUCTIONAL TIME: 8.01, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Cleans engine properly using proper cleaning materials and solutions.
- Uses safety precautions involved.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont

TASK NUMBER: 8.02 TITLE: Remove and Replace Tail Pipe Assemblies.

INSTRUCTIONAL OBJECTIVE - 8.02: How to Remove and Replace Tail Pipe Assemblies.

SKILLS: (Process Objectives)

8.021 - How to remove and replace tail pipe assemblies.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Knowledge of proper removal and installation tools.

REQUIRED INSTRUCTIONAL TIME: 8.02, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces tailpipe assemblies with no rattles or leaks. Flat rate + 20%.
- Uses proper removal and installation tools and equipment. Observes required safety practices.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.03 TITLE: Remove and Replace Muffler.

INSTRUCTIONAL OBJECTIVE - 8.03: How to Remove and Replace Muffler.

SKILLS: (Process Objectives)

8.031 - How to remove and replace a muffler.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Knowledge of proper removal and installation equipment.
- Knowledge of what is legal and illegal regarding mufflers.

REQUIRED INSTRUCTIONAL TIME: 8.03, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces muffler with no rattles or leaks. Flat rate + 20%.
- Uses proper removal and installation tools and equipment. Observes required safety practices.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'

TASK NUMBER: 8.04 TITLE: Inspect Exhaust Systems.

INSTRUCTIONAL OBJECTIVE - 8.04: How to Inspect Exhaust Systems.

SKILLS: (Process Objectives)

8.041 - How to inspect the exhaust system.

RELATED TECHNICAL INFORMATION:

- Inspection steps.
- Knowledge of what to look for.

REQUIRED INSTRUCTIONAL TIME: 8.04, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects exhaust system and determines if system is leaking, rattling or defective in any way.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.051 TITLE: Inspect Exhaust Manifold.

INSTRUCTIONAL OBJECTIVE - 8.051: How to Inspect Exhaust Manifold.

SKILLS: (Process Objectives)

8.0511 - How to inspect exhaust manifold.

RELATED TECHNICAL INFORMATION:

- Inspection steps.
- Knowledge of what to look for.

REQUIRED INSTRUCTIONAL TIME: 8.051, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects exhaust manifold for leaks or cracks, detects problems, if any, with 95% accuracy.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'

TASK NUMBER: 8.052 TITLE: Remove and Replace Exhaust Manifold.

INSTRUCTIONAL OBJECTIVE - 8.052: How to Remove and Replace Exhaust Manifold.

SKILLS: (Process Objectives)

8.0521 - How to remove and replace exhaust manifold.

RELATED TECHNICAL INFORMATION:

- Precautions involved in the removal and replacement of exhaust manifold.

REQUIRED INSTRUCTIONAL TIME: 8.052, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces exhaust manifold to vehicle standards with no leaks or rattles, Flat rate + 20%.
- Uses necessary precautions involved in the removal and replacement of exhaust manifold.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.06 TITLE: Remove and Replace Engine Mounts.

INSTRUCTIONAL OBJECTIVE - 8.06: How to Remove and Replace Engine Mounts.

SKILLS: (Process Objectives)

8.061 - How to remove and replace engine mounts.

RELATED TECHNICAL INFORMATION:

- Knowledge of how to determine faulty mounts.
- Knowledge of safety rules involved.

REQUIRED INSTRUCTIONAL TIME: 8.06, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces defective engine mounts using necessary precautions involved. Flat rate + 20%.
- Takes necessary steps in determining if mounts are defective. Uses safety precautions.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'

TASK NUMBER: 8.071 TITLE: Perform Operational Inspections of Positive Crankcase Ventilation Systems.

INSTRUCTIONAL OBJECTIVE - 8.071: How to Perform the Inspections of Positive Crankcase Ventilation Systems.

SKILLS: (Process Objectives)

8.0711 - How to perform the inspection of positive crankcase ventilation systems.

RELATED TECHNICAL INFORMATION:

- Knowledge of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.071, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects positive crankcase ventilation system for adequate ventilation according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.072 TITLE: Repair or Service Crankcase Ventilation Systems.

INSTRUCTIONAL OBJECTIVE - 8.072: How to Repair or Service Crankcase Ventilation Systems.

SKILLS: (Process Objectives)

8.0721 - How to repair or service crankcase ventilation.

RELATED TECHNICAL INFORMATION:

- Knowledge of proper cleaning of filter and their use.

REQUIRED INSTRUCTIONAL TIME: 8.072, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Repairs or services crankcase ventilation to maintain adequate ventilation according to manufacturer's specifications. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.

TASK NUMBER: 8.081 TITLE: Run Compression Test.

INSTRUCTIONAL OBJECTIVE - 8.081: How to Run Compression Test.

SKILLS: (Process Objectives)

8.0811 - How to perform a compression check.
8.0812 - How to use compression tester.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's manual and tester.

REQUIRED INSTRUCTIONAL TIME: 8.081, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs compression check accurately according to manufacturer's specification.
- Uses proper steps in making compression check. Flat rate + 20%.
- Uses compression tester properly and carefully according to manufacturer's manual.
- Determines amount of compression on each cylinder.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.082 TITLE: Perform Cylinder Leakage Test.

INSTRUCTIONAL OBJECTIVE - 8.082: How to Perform Cylinder Leakage Test.

SKILLS: (Process Objectives)

8.0821 - How to perform a cylinder leakage test.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications and tester.

REQUIRED INSTRUCTIONAL TIME: 8.082, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs cylinder leakage test according to manufacturer's specifications.
- Determines amount of cylinder leakage on each cylinder. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd

TASK NUMBER: 8.083 TITLE: Perform Cylinder Balance Test.

INSTRUCTIONAL OBJECTIVE - 8.083: How to Perform Cylinder Balance Test.

SKILLS: (Process Objectives)

8.0831 - How to perform cylinder balance test.
8.0832 - How to use test equipment.

RELATED TECHNICAL INFORMATION:

- Knowledge and use of proper test equipment.

REQUIRED INSTRUCTIONAL TIME: 8.083, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs cylinder balance test according to vehicle standards. Determines if engine is operating properly. Flat rate + 20%.
- Uses proper test equipment and uses it according to equipment manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.084 TITLE: Diagnose Valve Train and Head Malfunctions.

INSTRUCTIONAL OBJECTIVE - 8.084: How to Diagnose Valve Train and Head Malfunctions.

SKILLS: (Process Objectives)

8.0841 - How to diagnose valve train and head malfunctions.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications and technical manuals.
- Equipment manufacturer's instructions manual.

REQUIRED INSTRUCTIONAL TIME: 8.084, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Diagnoses valve train and head malfunctions to determine proper operation according to manufacturer's specifications and technical manuals.
- Uses proper testing equipment according to equipment manufacturer's instructions.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.09 TITLE: Clean Engine Parts and Make Visual Check for Condition.

INSTRUCTIONAL OBJECTIVE - 8.09: How to Clean Engine Parts and Make Visual Check For Condition.

SKILLS: (Process Objectives)

8.091 - How to clean engine parts and make visual checks for condition.

RELATED TECHNICAL INFORMATION:

- Knowledge of and use of solvents.
- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.09, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Cleans engine parts and determines amount of wear or if part may be defective according to manufacturer's specifications.
- Uses proper precision measuring tools accurately. Flat rate + 20%.
- Uses proper cleaning materials and solvents.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.10 TITLE: Remove and Replace Pan and Valve Covers.

INSTRUCTIONAL OBJECTIVE - 8.10: How to Remove and Replace Pan and Valve Covers.

SKILLS: (Process Objectives)

8.101 - How to remove and replace pan and valve covers.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's manuals.

REQUIRED INSTRUCTIONAL TIME: 8.10, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces pan and valve covers properly with no leaks. Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd

TASK NUMBER: 8.11 TITLE: Perform Operational Inspections of Engine Lubrication Systems.

INSTRUCTIONAL OBJECTIVE - 8.11: How to Perform Operational Inspections of Engine Lubrication Systems.

SKILLS: (Process Objectives)

8.111 - How to perform operational inspection of the engine lubrication system.
8.112 - How to use pressure tester.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Operation of pressure tester.

REQUIRED INSTRUCTIONAL TIME: 8.11, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs operational inspection of the lubrication system to determine if system is working properly or if system is faulty. Makes correct diagnosis at least 80% of time.
- Uses proper pressure tester and uses it properly.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.12 TITLE: Remove and Replace Gaskets and Seals.

INSTRUCTIONAL OBJECTIVE - 8.12: How to Remove and Replace Gaskets and Seals.

SKILLS: (Process Objectives)

8.121 - How to remove and replace gaskets and seals.

RELATED TECHNICAL INFORMATION:

- Types, purposes and characteristics of gaskets and seals.
- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.12, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces gaskets and seals with no leaks. Flat rate + 20%.
- Uses proper seal installation tools.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.13 TITLE: Remove and Replace Head Gaskets.

INSTRUCTIONAL OBJECTIVE - 8.13: How to Remove and Replace Head Gaskets.

SKILLS: (Process Objectives)

8.131 - How to remove and replace head gaskets.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.13, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces head gasket and on completion obtains proper engine operation, according to manufacturer's specifications. Flat rate + 20%.
- Uses proper tools and takes necessary precautions involved.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.14 TITLE: Inspect Head for Warp.

INSTRUCTIONAL OBJECTIVE - 8.14: How to Inspect Head for Warp.

SKILLS: (Process Objectives)

8.141 - How to inspect head for warpage.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.14, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects cylinder head to determine if it is defective, according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.

TASK NUMBER: 8.151 TITLE: Adjust Valves.

INSTRUCTIONAL OBJECTIVE - 8.151: How to Adjust Valves.

SKILLS: (Process Objectives)

8.1511 - How to adjust valves.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.151, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Adjusts valves properly and accurately to manufacturer's specifications.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.152 TITLE: Remove and Replace Valves.

INSTRUCTIONAL OBJECTIVE - 8.152: How to Remove and Replace Valves.

SKILLS: (Process Objectives)

8.1521 - How to remove and replace valves.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.152, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces valves properly, according to manufacturer's specification.
- Flat rate + 20%.
- Uses proper removal and installation tools and equipment.
- Takes necessary procedural precautions required.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.16 TITLE: Grind Valves.

INSTRUCTIONAL OBJECTIVE - 8.16: How to Grind Valves.

SKILLS: (Process Objectives)

8.161 - How to grind valves.
8.162 - How to use valve grinding tools.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Valve grinding tools.

REQUIRED INSTRUCTIONAL TIME: 8.16, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Grinds valves properly and accurately according to manufacturer's specification.
- Flat rate + 20%.
- Uses valve grinding tools and equipment carefully, taking all necessary safety and procedural precautions.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.17 TITLE: Resurface Valve Seats and Knurl Valve Guides.

INSTRUCTIONAL OBJECTIVE - 8.17: How to Resurface Valve Seats and Knurl Valve Guides.

SKILLS: (Process Objectives)

8.171 - How to resurface valve seats.
8.172 - How to use valve seat surfacing machine.
8.173 - How to knurl valve guides.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Operation of valve seat surfacing machine.
- Valve guide servicing set manual.

REQUIRED INSTRUCTIONAL TIME: 8.17, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Resurfaces valve seats properly and accurately according to manufacturer's specifications. Flat rate + 20%.
- Uses valve seat surfacing machine carefully, taking all necessary procedural precautions.
- Knurls valve guides according to appropriate manual.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.18 TITLE: Remove and Replace Valve Lifters.

INSTRUCTIONAL OBJECTIVE - 8.18: How to Remove and Replace Valve Lifters.

SKILLS: (Process Objectives)

8.181 - How to remove and replace valve lifters.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Cautions in regards to cleanliness.

REQUIRED INSTRUCTIONAL TIME: 8.18, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces valve lifters properly according to manufacturer's specifications. Flat rate + 20%.
- Takes all necessary precautions in regards to cleanliness and safety.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.19 TITLE: Remove and Replace Valve Guides.

RELATED TECHNICAL INFORMATION:

- Job for the machine shop.

NOT TAUGHT

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.20 TITLE: Remove and Replace Valve Seats.

RELATED TECHNICAL INFORMATION:

- Job for the machine shop.

NOT TAUGHT

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd

TASK NUMBER: 8.21 TITLE: Machine Valve Guides for Special Seals.

INSTRUCTIONAL OBJECTIVE - 8.21: How to Machine Valve Guides for Special Seals.

SKILLS: (Process Objectives)

8.211 - How to machine valve guides for special seals.
8.212 - How to use special tools.

RELATED TECHNICAL INFORMATION:

- Required use of special tools for installation.

REQUIRED INSTRUCTIONAL TIME: 8.21, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Machines valve guides for special seals with no defect in workmanship according to manufacturer's specifications. Flat rate + 20%.
- Uses special tools carefully and takes all necessary precautions.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.22 TITLE: Remove and Replace Oil Pumps.

INSTRUCTIONAL OBJECTIVE - 8.22: How to Remove and Replace Oil Pumps.

SKILLS: (Process Objectives)

8.221 - How to remove and replace oil pump.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.22, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces oil pump and obtains sufficient lubrication system operation, with no leaks, according to manufacturer's specifications.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.23 TITLE: Repair Oil Pumps.

INSTRUCTIONAL OBJECTIVE - 8.23: How to Repair Oil Pumps.

SKILLS: (Process Objectives)

8.231 - How to repair oil pumps.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.23, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Repairs oil pump, obtaining sufficient lubrication system operation, with no leaks, according to manufacturer's specifications.
- Takes all necessary precautions.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.24 TITLE: Remove and Replace Timing Gears and Chains.

INSTRUCTIONAL OBJECTIVE - 8.24: How to Remove and Replace Timing Gears and Chains.

SKILLS: (Process Objectives)

8.241 - How to remove and replace timing gears and chains.
8.242 - How to use proper special tools.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Required special tools.

REQUIRED INSTRUCTIONAL TIME: 8.24, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Replaces timing gear and chain properly, using correct tools, with no leaks, according to manufacturer's specifications.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.25 TITLE: Remove and Replace Flywheel.

INSTRUCTIONAL OBJECTIVE - 8.25: How to Remove and Replace Flywheel.

SKILLS: (Process Objectives)

8.251 - How to remove and replace flywheel.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.25, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces flywheel to proper torque according to manufacturer's specifications.
- Takes all necessary precautions involved.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.26 TITLE: Remove and Replace Flywheel Ring Gears.

INSTRUCTIONAL OBJECTIVE - 8.26: How to Remove and Replace Flywheel Ring Gears.

SKILLS: (Process Objectives)

8.261 - How to remove and replace flywheel ring gear.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Heat treating procedures for ring gear.
- Safety involved in replacing flywheel ring gear.

REQUIRED INSTRUCTIONAL TIME: 8.26, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces flywheel ring gear properly having correct starter and flywheel engagement, according to manufacturer's specifications. Flat rate + 20%.
- Takes all necessary safety precautions.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.27 TITLE: Remove and Replace Engines from Vehicles.

INSTRUCTIONAL OBJECTIVE - 8.27: How to Remove and Replace Engines from Vehicles.

SKILLS: (Process Objectives)

8.271 - How to remove and replace vehicle engine.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Safety precautions involved in the removal and replacement of engines.
- Marking and identification of electrical wiring.

REQUIRED INSTRUCTIONAL TIME: 8.27, 14 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces engine according to manufacturer's specifications. Engine is properly secured and operates properly. Flat rate + 20%. Observes safety precautions.
- Takes all necessary precautions involved in marking electrical wiring.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.28 TITLE: Remove and Replace Connecting Rods and Bearings.

INSTRUCTIONAL OBJECTIVE - 8.28: How to Remove and Replace Connecting Rods and Bearings.

SKILLS: (Process Objectives)

8.281 - How to remove and replace connecting rods and bearings.
8.282 - How to use plastigauge.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Purpose of plastigauge.
- Cautions in proper assembly and torque.

REQUIRED INSTRUCTIONAL TIME: 8.28, 14 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces connecting rod and bearing.
- Rod and piston is installed properly and has proper bearing clearance.
- Flat rate + 20%.
- Uses precision measuring instruments carefully and accurately.
- Takes all necessary procedural precautions in assembly and torque.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.

TASK NUMBER: 8.29 TITLE: Remove and Replace Pistons.

INSTRUCTIONAL OBJECTIVE - 8.29: How to Remove and Replace Pistons.

SKILLS: (Process Objectives)

8.291 - How to remove and replace pistons.
8.292 - How to use ridge reamer and cylinder hone.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Requirement for ridge reamer and cylinder hone.

REQUIRED INSTRUCTIONAL TIME: 8.29, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces pistons maintaining proper piston to cylinder wall clearance, according to manufacturer's specifications. Flat rate + 20%.
- Uses proper tools and equipment taking all necessary procedural precautions required to assure proper engine operation.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.30 TITLE: Remove and Replace Rings on Pistons.

INSTRUCTIONAL OBJECTIVE - 8.30: How to Remove and Replace Rings on Pistons.

SKILLS: (Process Objectives)

8.301 - How to remove and replace piston rings.
8.302 - How to use ring groove cleaner.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Precautions in removal and replacing rings.
- Precautions in the use of the ring groove cleaner.

REQUIRED INSTRUCTIONAL TIME: 8.30, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces piston rings, taking all precautions in replacing rings.
- Assures that all rings have proper ring end gap, according to manufacturer's specification. Flat rate + 20%.
- Cleans ring grooves with proper tool, taking all necessary precautions to assure correct engine operation.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.

TASK NUMBER: 8.31 TITLE: Remove and Replace Crankshaft and Bearings.

INSTRUCTIONAL OBJECTIVE - 8.31: How to Remove and Replace Crankshaft and Bearings.

SKILLS: (Process Objectives)

8.311 - How to remove and replace crankshaft and bearings.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Precautions in the installation of bearings.
- Use of plastigauge.

REQUIRED INSTRUCTIONAL TIME: 8.31, 14 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces crankshaft and bearings, assuring proper bearing clearance according to manufacturer's specifications. Flat rate + 20%.
- Takes all precautions in installation of bearings and uses proper measuring instrument correctly.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.32 TITLE: Inspect Crankshaft and Connecting Rod Assembly Using Micrometers and Other Equipment.

INSTRUCTIONAL OBJECTIVE - 8.32: How to Inspect Crankshaft and Connecting Rod Assembly Using Micrometers and Other Equipment.

SKILLS: (Process Objectives)

8.321 - How to inspect the crankshaft and connecting rod assembly using micrometer and other equipment.
8.322 - How to use micrometer.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Need for micrometer.

REQUIRED INSTRUCTIONAL TIME: 8.32, 14 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects crankshaft and rod assembly according to manufacturer's specifications.
- Flat rate + 20%.
- Uses micrometer being very accurate. Allows tolerances according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.

TASK NUMBER: 8.33 TITLE: Inspect and Correct Bearing Fit.

INSTRUCTIONAL OBJECTIVE - 8.33: How to Inspect and Correct Bearing Fit.

SKILLS: (Process Objectives)

8.331 - How to inspect and correct bearing fit.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Use of plastigauge.

REQUIRED INSTRUCTIONAL TIME: 8.33, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects bearing for correct fit according to manufacturer's specification.
- Uses plastigauge and precision measuring instruments correctly and accurately.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.34 TITLE: Remove and Replace Camshaft.

INSTRUCTIONAL OBJECTIVE - 8.34: How to Remove and Replace Camshaft.

SKILLS: (Process Objectives)

8.341 - How to remove and replace camshaft.
8.342 - How to use camshaft puller.

RELATED TECHNICAL INFORMATION:

- Use of manufacturer's specifications.
- Purpose of camshaft puller.

REQUIRED INSTRUCTIONAL TIME: 8.34, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces camshaft using camshaft puller according to manufacturer's specifications. Flat rate + 20%.
- Uses special tools very carefully and correctly, with speed and accuracy.

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine - Maintenance, Repair & Overhaul (cont'd.)

TASK NUMBER: 8.35 TITLE: Remove and Replace Camshaft Bearings.

INSTRUCTIONAL OBJECTIVE - 8.35: How to Remove and Replace Camshaft Bearings.

SKILLS: (Process Objectives)

8.351 - How to remove and replace camshaft bearings.
8.352 - How to use cam bearing removal and insertion tool.

RELATED TECHNICAL INFORMATION:

- Need for the cam bearing removal and insertion tool.
- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 8.35, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces camshaft bearings according to manufacturer's specifications.
- Flat rate + 20%.
- Uses cam bearing tool correctly and very carefully, with speed and accuracy.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Engine Maintenance, Repair and Overhaul

Set micrometers
Cam bearing tool set
Cylinder dial gauge
Valve grinder
Valve set grinder
Bearing leak detector
Valve spring compressor
Cylinder deglazing hone
Valve spring tension gauge
Hydraulic lifter tester
Valve keeper inserter
L-head valve spring compressor
Ridge reamer
Piston ring groove cleaner
Ribbon feeler gauges
Ring installer and remover
Ring compressor
Set of pullers
Torque wrench
Squirt can
Rear main bearing seal inserter
Tap and die set
Spark plug tap set
Valve guide servicing set
Parts washer
Crankshaft damper puller
Camshaft remover and replacement tool
Valve seat runout gauge
Inside micrometer set to 5"
Outside micrometer set to 5"
Cylinder bore gauge
Connecting rod alignment fixture
Small hole gauge
Universal dial indicator
Feeler gauge
Straight edge

TEST ITEMS

BLOCK OR DIVISION: 8.0 TITLE: Engine Maintenance, Repair and Overhaul

Given an automobile engine with the exhaust system attached, the student will demonstrate the ability to perform any of the tasks listed to the satisfaction of the instructor. In addition, the following conditions and performance standards will be applied to all items:

1. Student selects the correct tools, equipment and materials for the task and uses them properly.
2. Work is done according to manufacturer's specifications.
3. Work is performed within the time limits of flat rate plus 20%.
4. Safety precautions are observed.

TASK

8.01 Clean the engine

~~8.02 Remove and replace the tail pipe.~~

~~8.03 Remove and replace the muffler.~~

8.04 Inspect the exhaust system.

8.051 Inspect the exhaust manifold.

8.052 Remove and replace the exhaust manifold.

8.06 Remove and replace engine mounts.

8.07 Perform operational inspection of positive crankcase ventilation system.

8.072 Repair or service crankcase ventilation system as directed by instructor.

8.081 Run a compression test.

8.082 Perform a cylinder leakage test.

8.083 Perform a cylinder balance test.

8.084 Diagnose valve train and head malfunctions.

8.09 Clean designated engine parts and make visual check for condition and wear.

8.10 Remove and/or replace the pan and valve covers.

8.11 Perform an operational inspection of engine lubricating system.

8.12 Remove and/or replace designated gaskets and seals.

8.13 Remove and replace the head gasket.

TEST ITEMS (CON'T.)

BLOCK OR DIVISION: 8.0 TITLE: Engine Maintenance, Repair and Overhaul

TASK

8.14 Inspect the head for warp.

8.151 Adjust valves.

8.152 Remove and replace valves.

8.16 Grind Valves.

8.17 Resurface valve seats.

8.18 Remove and/or replace valve lifters.

8.21 Machine valve guides for special seals.

8.22 Remove and/or replace the oil pump.

8.23 Repair oil pump.

8.24 Remove and replace timing gears and chains.

8.25 Remove and replace flywheel.

8.26 Remove and replace flywheel ring gears.

8.27 Remove and/or replace engine from vehicle.

8.28 Remove and replace designated connecting rods and bearings.

8.29 Remove and replace designated piston(s).

8.30 Remove and replace rings on designated piston(s).

8.31 Remove and replace crankshaft and bearings.

8.32 Inspect crankshaft and at least one connecting rod assembly using micrometers and required equipment.

8.33 Inspect and correct bearing fit.

8.34 Remove and replace the camshaft.

8.35 Remove and replace camshaft bearings.

NOTE 1: For testing purposes, satisfactory first time performance of certain tasks which require repetitive acts, ie: grind valves, may be considered as adequate evidence of task performance qualification. (This performance would permit a number of students to be tested on the same task in less time.)

NOTE 2: Students must meet required performance standards for at least 80% of the tasks in the block of instruction to be certified as occupationally qualified.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 8.0 TITLE: Automotive Engine Maintenance and Repair (Engine Exhaust System)

1. List the types of exhaust systems.

   a. ____________________ Uses one exhaust pipe, muffler, and tail pipe

   b. ____________________ Uses two separate exhaust pipes, mufflers, and tail pipes

2. Describe the danger of a leaking exhaust system or operating an engine in a closed shop.

3. a. Describe the cause of internal exhaust system corrosion.

   b. Describe the cause of external exhaust system corrosion.

4. The student should demonstrate the ability to perform the following jobs to the satisfaction of the instructor.

   a. Remove and replace an exhaust manifold.
   b. Remove and replace an exhaust pipe.
   c. Remove and replace a muffler.
   d. Remove and replace a tail pipe.
   e. Service a manifold heat control.

TEST ANSWERS:

1. a. Single
   b. Dual

2. Exhaust gases contain carbon monoxide, a deadly poison.

3. a. Water caused by the combustion process collects in the muffler; corrosion is extreme if vehicle is used primarily for short drives.

   b. Rusting occurs due to rain, snow, and humidity; corrosion is accelerated by the use of salt on icy road surfaces.

4. Performance skills will be evaluated by the instructor. Manufacturer's specifications and flat rate plus 20% apply.

ARTICULATION RESEARCH PROJECT
Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Automobile Heater and Air Conditioner Maintenance and Repair (Block 9.0)*

COURSE DESCRIPTION: Department of Public Instruction - Not identified as part of the primary areas of emphasis in current courses of instruction.

Department of Community Colleges - AHR 1101 Auto Air Conditioning.

INSTRUCTIONAL CONTACT HOURS: High Schools: None. (This course of instruction will not be taught at the high school level, owing to the lack of instructional time and complex equipment requirements.)

CC/TI: 146*

(*Note: Additional instructional time provided in Block 12.0 - Automotive Servicing. Instruction required for Block 3.0 Automobile Heater should be conducted concurrently with Block 9.0)

INSTRUCTIONAL OBJECTIVES:

High Schools: Not taught as a high school course of instruction.
Post-Secondary Schools: To provide the learner with the necessary occupational instruction and opportunity for practical application to develop the skills and knowledge of related technical information necessary to qualify the learner to inspect, service, maintain, repair, or replace components of the automobile heater and air conditioner system, according to the manufacturer's specifications and to meet industry performance standards.

QUALIFICATION OR JOB SKILLS GAINED:

Successful completion of this block of instruction and Block 3.0 qualifies the learner to perform the inspections, service, maintain, repair, or replace, of the components of the automobile heating and air conditioning system. With validation of this qualification by performance evaluation, using industry standards plus Block 3.0 (Automobile Heater Maintenance and Repair), the learner is considered to be qualified as an Automotive Heating and Air Conditioning Technician.

PREREQUISITES:

High Schools: Not applicable
Community College/
Technical Institute: Block 0.0 (Introduction to Automotive Technology)

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance, but also include a requirement for knowledge of related technical information. The test items are outline in nature and require specific data to complete the situation or problem, relate directly to the instructional objectives and are considered to be both valid and reliable.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program of instruction. Special equipment and tool requirements peculiar to this block are attached.

*Title applies to all instructional objective page titles in Block 9.0

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

Automotive

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair

TASK NUMBER: 9.01 TITLE: Remove and Replace Air Conditioner Fan Motor.

INSTRUCTIONAL OBJECTIVE - 9.01: How to Remove and Replace Air Conditioner Fan Motor.

SKILLS: (Process Objectives)

9.011 - How to remove and replace the air conditioner fan motor.

RELATED TECHNICAL INFORMATION:

- Know correct procedures for removal of fan motor.
- Applicable shop manual.
- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 9.01, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20%.
- Motor operates properly and no noise.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.021 TITLE: Discharge Air Conditioner System.

INSTRUCTIONAL OBJECTIVE - 9.021: How to Discharge An Air Conditioner System.

SKILLS: (Process Objectives)

9.0211 - How to use a manifold gauge set.
9.0212 - How to discharge an air conditioner system.
9.0213 - How to perform a pressure test.

RELATED TECHNICAL INFORMATION:

- Fundamentals of refrigeration.
- Air conditioner components.
- Safety rules in the discharge of an automobile air conditioner.
- Purpose of pressure test.

REQUIRED INSTRUCTIONAL TIME: 9.021, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Observes safety precautions correctly.
- Performs task in flat rate + 20% time.
- Hooks up manifold gauge set correctly.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.022 TITLE: Evacuate and Charge An Auto Air Conditioner System.

INSTRUCTIONAL OBJECTIVE - 9.022: How to Evacuate and Charge An Auto Air Conditioner System.

SKILLS: (Process Objectives)

9.0221 - How to use a vacuum pump.
9.0222 - How to evacuate and charge an auto air conditioner system.

RELATED TECHNICAL INFORMATION:

- Fundamentals of refrigeration.
- Air conditioner components.
- Know procedures in the use of the manifold gauge set.
- Know procedures in the use of the vacuum pump.
- Know safety considerations in the charging of the air conditioner.

REQUIRED INSTRUCTIONAL TIME: 9.022, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Observes safety precautions correctly.
- Hooks up manifold gauge set correctly.
- Hooks up vacuum pump correctly.
- Performs task to manufacturer's specifications.
- Performs task in flat rate + 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'

TASK NUMBER: 9.023 TITLE: Perform A Leak Test on the Auto Air Conditioner System.

INSTRUCTIONAL OBJECTIVE - 9.023: How to Perform A Leak Test on the Auto Air Conditioner System.

SKILLS: (Process Objectives)

9.0231 - How to use a halide leak detector.
9.0232 - How to use an electronic leak detector.
9.0233 - How to perform a leak test on an auto air conditioner.

RELATED TECHNICAL INFORMATION:

- Fundamentals of refrigeration.
- Know air conditioner component parts.
- Operation of the halide leak detector.
- Operation of the electronic leak detector.
- Safety precautions.

REQUIRED INSTRUCTIONAL TIME: 9.023, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Observes safety precautions.
- Uses leak detector correctly.
- Performs task to manufacturer's specifications.
- Performs task in flat rate + 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.03 TITLE: Remove and Replace Dryer in Air Conditioning Unit.

INSTRUCTIONAL OBJECTIVE - 9.03: How to Remove and Replace Dryer in Air Conditioning Unit.

SKILLS: (Process Objectives)

9.031 - How to remove and replace dryer in air conditioning unit.

RELATED TECHNICAL INFORMATION:

- Know air conditioner components.
- Fundamentals of refrigeration.
- Steps in discharge and evacuation of air conditioner system.
- Steps in performance of leak test of air conditioner system.

REQUIRED INSTRUCTIONAL TIME: 9.03, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Observes safety precautions.
- Dryer should be installed according to manufacturer's specifications with no leaks.
- System should be evacuated and charged correctly.
- Performs task in flat rate + 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.04 TITLE: Service Air Conditioner Control Cables and Switches.

INSTRUCTIONAL OBJECTIVE - 9.04: How to Service Air Conditioner Control Cables and Switches.

SKILLS: (Process Objectives)

9.041 - How to service air conditioner cables.
9.042 - How to diagnose control cable troubles.
9.043 - How to replace air conditioner control cables.
9.044 - How to service air conditioner switches.
9.045 - How to diagnose air conditioner switch troubles.
9.046 - How to replace air conditioner switches.

RELATED TECHNICAL INFORMATION:

- Applicable shop manual.
- Know steps in diagnosing control cable troubles.
- Know steps in replacing control cables.
- Know steps in diagnosing switch troubles.
- Know steps in replacing air conditioner switches.

REQUIRED INSTRUCTIONAL TIME: 9.04, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Cables work freely and correctly to manufacturer's specifications. [9.041 & 9.043]
- Performs task in flat rate + 20% time.

- Switches work freely and correctly to manufacturer's specifications. [9.044 & 9.046]
- Performs task in flat rate + 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.05 TITLE: Remove and Replace Freon Control Valve in Air Conditioning Unit.

INSTRUCTIONAL OBJECTIVE - 9.05: How to Remove and Replace Freon Control Valve in Air Conditioning Unit.

SKILLS: (Process Objectives)

9.051 - How to diagnose freon control valve.
9.052 - How to remove and replace freon control valve.
9.053 - How to remove and replace P.O.A. valve.
9.054 - How to remove and replace E.P.R. valve.

RELATED TECHNICAL INFORMATION:

- Applicable shop manual.
- Know safety precautions.
- Know air conditioner fundamentals.
- Know air conditioner components.
- Know steps to discharge, evacuate, and charge an air conditioner system.
- Know steps for leak test and pressure test of air conditioner system.

REQUIRED INSTRUCTIONAL TIME: 9.05, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Valve works properly with no leaks according to manufacturer's specifications.
- Evacuates, leak tests, and charges the system.
- Performs task in flat rate + 20%.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.06 TITLE: Remove and Replace Expansion Valve in Air Conditioning Unit.

INSTRUCTIONAL OBJECTIVE - 9.06: How to Remove and Replace Expansion Valve in Air Conditioning Unit.

SKILLS: (Process Objectives)

9.061 - How to remove and replace expansion valve in air conditioning unit.
9.062 - How to diagnose the expansion valve.

RELATED TECHNICAL INFORMATION:

- Know refrigeration fundamentals.
- Know air conditioner components.
- Know safety precautions.
- Know proper sequence of steps to remove and replace expansion valve.
- Know steps to diagnose the expansion valve.
- Applicable shop manuals.
- Know proper steps to discharge, evacuate, and charge air conditioner systems.
- Know steps in leak test of air conditioning system.

REQUIRED INSTRUCTIONAL TIME: 9.06, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Valve works properly with no leaks, according to manufacturer's specifications.
- Student evacuates, leak tests, and charges the system.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.07 TITLE: Remove and Replace Compressor Seals.

INSTRUCTIONAL OBJECTIVE - 9.07: How to Remove and Replace Compressor Seals.

SKILLS: (Process Objectives)

9.071 - How to remove and replace compressor seals

9.0711 - General Motors Air Conditioner.
9.0712 - York Air Conditioner.
9.0713 - Tecumseh Air Conditioner.
9.0714 - Chrysler Air Conditioner.

RELATED TECHNICAL INFORMATION:

- Know refrigeration fundamentals.
- Know air conditioner components.
- Know safety precautions.
- Know steps to leak test the air conditioner system.
- Know steps to replace the seals for each manufacturer's air conditioner.
- Know steps to discharge, evacuate, and charge air conditioner systems.
- See applicable shop manuals.
- See manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 9.07, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Seals installed properly according to manufacturer's specifications, with no leaks.
- Evacuates, leak tests, and charges the system.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.08 TITLE: Remove and Replace Condenser in Air Conditioning Unit.

INSTRUCTIONAL OBJECTIVE - 9.08: How to Remove and Replace Condenser in Air Conditioning Unit.

SKILLS: (Process Objectives)

9.081 - How to remove and replace condenser in air conditioning unit.

RELATED TECHNICAL INFORMATION:

- Know safety precautions.
- Know refrigeration fundamentals.
- Know air conditioner components.
- See applicable shop manuals.
- See manufacturer's specifications.
- Know steps in discharge, evacuation, and charging of air conditioner system.
- Know steps in leak test and pressure test of air conditioning system.
- Know steps in the removal and replacement of air conditioner condenser.

REQUIRED INSTRUCTIONAL TIME: 9.08, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Condenser installed properly, with no leaks, according to manufacturer's specifications and applicable shop manual.
- Evacuates, leak tests, and charges the air conditioner.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.09 TITLE: Remove and Replace Evaporator in Air Conditioning Unit.

INSTRUCTIONAL OBJECTIVE - 9.09: How to Remove and Replace Evaporator in Air Conditioning Unit.

SKILLS: (Process Objectives)

9.091 - How to remove and replace evaporator in air conditioning unit.

RELATED TECHNICAL INFORMATION:

- Know safety precautions.
- Know refrigeration fundamentals.
- Know air conditioner components.
- See applicable shop manuals.
- See manufacturer's specifications.
- Know steps to discharge, evacuate and charge an air conditioner system.
- Know steps to leak test and pressure test an air conditioner system.
- Know steps to remove and replace evaporator in air conditioning unit.

REQUIRED INSTRUCTIONAL TIME: 9.09, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Evaporator installed properly with no leaks, according to manufacturer's specifications and applicable shop manual.
- Evacuates, leak tests, and charges the system.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.10 TITLE: Repair or Remove and Replace Air Conditioning Compressor.

INSTRUCTIONAL OBJECTIVE - 9.10: How to Repair or Remove and Replace Air Conditioning Compressor.

SKILLS: (Process Objectives)

9.101 - How to use special tools required for task.
9.102 - How to remove and replace air conditioning compressor.

RELATED TECHNICAL INFORMATION:

- Know safety precautions.
- Know refrigeration fundamentals.
- Know air conditioner components.
- See applicable shop manuals.
- See manufacturer's specifications.
- Know steps to discharge, evacuate, and charge air conditioner system.
- Know steps to leak test and pressure test an air conditioner system.
- Know steps to remove and replace air conditioning compressor.
- Know special tools required for task.

REQUIRED INSTRUCTIONAL TIME: 9.10, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Compressor installed correctly according to manufacturer's specifications, with no leaks. Uses special tools properly.
- Evacuates, leak tests, and charges the system.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.11 TITLE: Install Air Conditioners in Vehicles.

INSTRUCTIONAL OBJECTIVE - 9.11: How to Install Air Conditioners in Vehicles.

SKILLS: (Process Objectives)

9.111 - How to install air conditioners in vehicles.

RELATED TECHNICAL INFORMATION:

- Know safety precautions.
- Know refrigeration fundamentals.
- Know air conditioner components.
- See applicable shop manuals.
- See manufacturer's specifications.
- Know steps to discharge, evacuate, and charge air conditioner system.
- Know steps to leak test and performance test an air conditioner system.
- Know required special tools, their purpose and their use.

REQUIRED INSTRUCTIONAL TIME: 9.11, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Installs air conditioner correctly according to manufacturer's specifications, with no leaks.
- Evacuates, leak tests, and charges the system.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.12 TITLE: Do Performance Test of The System.

INSTRUCTIONAL OBJECTIVE - 9.12: How to Do Performance Test of The System.

SKILLS: (Process Objectives)

9.121 - How to do performance test of air conditioner system.

RELATED TECHNICAL INFORMATION:

- Know safety precautions.
- Know fundamentals of refrigeration.
- Know components of air conditioner.
- Know operation of air conditioner.
- Know necessity for performance tests.

REQUIRED INSTRUCTIONAL TIME: 9.12, 16 hours.

REQUIRED PERFORMANCE STANDARDS:

- Observes correct safety precautions.
- Uses test equipment correctly according to manufacturer's specifications.
- Performs tests correctly according to manufacturer's specifications.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.)

TASK NUMBER: 9.13 TITLE: Diagnose Air Conditioner Malfunctions.

INSTRUCTIONAL OBJECTIVE - 9.13: How to Diagnose Air Conditioner Malfunctions.

SKILLS: (Process Objectives)

9.131 - How to diagnose air conditioner malfunctions.

RELATED TECHNICAL INFORMATION:

- Know refrigeration fundamentals.
- Know air conditioner components.
- Know correct safety precautions.
- Know steps to pressure test, performance test, and leak test an air conditioner system.
- Know the steps to diagnose air conditioner malfunctions.
- Know how to use applicable shop manuals.

REQUIRED INSTRUCTIONAL TIME: 9.13, 25 hours.

REQUIRED PERFORMANCE STANDARDS:

- Conducts performance test and pressure test correctly according to manufacturer's specifications.
- Uses test equipment correctly according to manufacturer's specifications.
- Detects problem [if any] and makes correct diagnosis.
- Performs task in flat rate plus 20% time.

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioner Maintenance & Repair (cont'd.

TASK NUMBER: 9.14 TITLE: Repair Automatic Air Conditioner and Heater System Vacuum and Electrical Circuits.

INSTRUCTIONAL OBJECTIVE - 9.14: How to Repair Automatic Air Conditioner and Heater System Vacuum and Electrical Circuits.

SKILLS: (Process Objectives)

9.141 - How to repair automatic air conditioner and heater system vacuum circuits.
9.142 - How to repair automatic air conditioner and heater system electrical circuits.

RELATED TECHNICAL INFORMATION:

- Know required safety precautions.
- Know required special tools and equipment.
- Know refrigeration fundamentals.
- Know air conditioner components.
- Know heater fundamentals and components.
- Know applicable shop manuals.
- Know steps to diagnose vacuum circuits.
- Know steps to diagnose electrical circuits.
- Know manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 9.14, 65 hours.

REQUIRED PERFORMANCE STANDARDS:

- Uses air conditioner tester correctly according to manufacturer's specifications.
- Uses electrical circuit test equipment correctly according to manufacturer's specifications.
- Conducts performance test of air conditioner system.
- Automatic air conditioner works properly, with no leaks.
- Performs task in flat rate plus 20% time.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioning Maintenance and Repair

Voltmeter
Ammeter
Ohmmeter
Vacuum tester
Test light-non powered
Goggles
Refrigerant leak detecter
Thermometer (2)
Compressor service valve ratchet wrench
Refrigerant container valves
Compressor oil dipstick
Air conditioner charging station
  (Includes vacuum pumps, manifold gauge set, refrigerant reservoir)
Special tools for particular compressor being serviced
  (Refer to Shop Manual for tool numbers and application)
Freon can tapper
Air conditioning special tool set
Air-Care tester
Automatic temperature control tester

TEST ITEMS

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioning Maintenance & Repair

Related Technical Information. Multiple Choice - Circle the correct answer.

1. The compressor suction service valve mounts on:

   a. the low-pressure side
   b. the high-pressure side
   c. both low- and high-pressure sides

2. The compressor service valves are in the front-seated position when they are rotated:

   a. to the mid-position
   b. fully counterclockwise
   c. fully clockwise

3. In what position are the service valves when the system is in normal operation?

   a. front-seated
   b. back-seated
   c. mid-position
   d. it does not matter

4. When the manifold gauge set is connected into the refrigeration system, the gauges will indicate pressure with the gauge set valves:

   a. closed
   b. opened
   c. in any position

5. In order to install the manifold gauge set, the compressor service valves must be:

   a. front-seated (clockwise)
   b. back-seated (counterclockwise)
   c. in the center (mid-position)

6. The refrigeration system pressure test is performed with the manifold gauge set valves:

   a. closed
   b. opened
   c. either opened or closed

7. Which of the following is considered to be the normal range for compressor suction pressure?

   a. 350-500 P.S.I.
   b. 180-225 P.S.I.
   c. 10-20 P.S.I.

8. During the compressor test . . . the refrigerant system should be operated for a maximum of:

   a. 10 seconds
   b. 30 seconds
   c. 30 minutes

9. The leak test is performed with the engine:

   a. at normal operating temperature
   b. at idle speed
   c. turned off

10. A large refrigerant leak will turn the leak detector flame from pale blue to:

   a. greenish-yellow
   b. bright blue or purple
   c. scarlet red

11. The frigerant system should be evacuated whenever the:

   a. compressor is replaced
   b. system has been opened
   c. compressor is isolated

12. Generally . . . it takes about 20 to 30 minutes of vacuum pump operation to evacuate the system of all:

   a. refrigerant
   b. air
   c. moisture
   d. all of the above

13. A partial charge of refrigerant is recommended:

   a. when the system is low on refrigerant
   b. when outside air temperature and humidity are high
   c. when the condenser is hot
   d. for leak testing purposes

14. When charging the refrigerant system . . . the R-12 container must be:

   a. on its side
   b. upside down
   c. upright

15. The compressor oil level must be checked:

   a. each year
   b. after system evacuation
   c. after the system is charged

16. Which of the following is considered to be the most important when checking the compressor oil level?

   a. back-seating the compressor service valves
   b. discarding and replacing the oil fill plug
   c. making sure the dipstick bottoms in crankcase

17. The boiling point temperature of Refrigerant-12, when not confined is:

   a. 32°
   b. 0°
   c. about 22° below 0

18. When the R-12 liquid is released from a container, the:

    a. pressure is lowered
    b. boiling point is lowered
    c. liquid boils into a vapor
    d. all of the above

19. The air conditioning compressor is designed to compress:

    a. liquid
    b. vapor

20. When the refrigerant vapor is compressed into a smaller space, the vapor temperature is:

    a. lowered
    b. raised
    c. remains the same

21. When the refrigerant in the system is pressurized, the boiling point of the refrigerant is:

    a. higher
    b. lower
    c. the same

22. The condenser changes the R-12 to:

    a. low pressure liquid
    b. high pressure liquid
    c. low pressure vapor
    d. high pressure vapor

23. In the condenser, the high pressure R-12 vapor condenses into a liquid because:

    a. the boiling point is high
    b. the pressure is high
    c. the heated vapor temperature is lowered by the cooler outside air
    d. all of the above

24. True or False:
    The Receiver-Dehydrator acts as a storage tank for the R-12 vapor as it leaves the condenser.

    a. True
    b. False

25. The expansion valve controls the pressure/temperature relationship in the:

    a. condenser
    b. evaporator
    c. receiver
    d. compressor

26. If the expansion valve temperature sensing bulb senses the engine compartment temperature, the expansion valve will be:

    a. opened
    b. closed

27. The expansion valve changes the high pressure R-12 liquid to a:

    a. high pressure vapor
    b. low pressure atomized liquid
    c. high pressure liquid

28. The evaporator changes the low pressure R-12 atomized liquid to a:

    a. high pressure vapor
    b. low pressure liquid
    c. low pressure vapor

29. Dehumidification of the passenger compartment air is accomplished:

    a. when the R-12 circulates through the drier in the receiver
    b. when the moist particles of air cling to the cold surfaces of the evaporator fins
    c. when the air passes through the heater core

30. The thermostatic switch opens the clutch circuit when the:

    a. evaporator is too warm
    b. evaporator is too cold
    c. passenger compartment temperature is too low

31. True or False:
    The A/C compressor clutch assembly is engaged by magnetic induction.

    a. True
    b. False

32. Refrigerant-12, used in a confined area:

    a. is OK
    b. could cause suffocation
    c. will cool the area

Performance Standards: 80% correct responses required when five or more test items are used.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 9.0 TITLE: Automobile Air Conditioning Maintenance and Repair

TASK

9.01 The student will remove and replace air conditioner fan motor to the satisfaction of the instructor in flat rate plus 20% with motor operating properly with no noise.

9.021 The student will discharge air conditioner system in flat rate plus 20% to the satisfaction of the instructor.

9.022 The student will evacuate and charge an air conditioner system in flat rate plus 20% to the satisfaction of the instructor following manufacturer's specifications.

9.023 The student will perform leak test on air conditioner system in flat rate plus 20% to the satisfaction of the instructor following manufacturer's specifications.

9.03 The student will remove and replace dryer in air conditioning unit according to manufacturer's specifications in flat rate plus 20% to the satisfaction of the instructor.

9.04 The student will service and replace, if needed, air conditioner control cables and switches per manufacturer's specifications in flat rate plus 20% to the satisfaction of the instructor.

9.05 The student will remove and replace freon control valve in air conditioning unit properly per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.06 The student will remove and replace expansion valve in air conditioning unit per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.07 The student will remove and replace compressor seals per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.08 The student will remove and replace condenser in air conditioning unit per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.09 The student will remove and replace evaporator in air conditioning unit per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

TASK

9.10 The student will repair or remove and replace air conditioning compressor per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.11 The student will install an air conditioning unit in a vehicle per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.12 The student will do performance test of the system per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.13 The student will perform malfunction check on air conditioner and set per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

9.14 The student will repair automatic air conditioner and heater system vacuum and electrical circuits per manufacturer's specifications to the satisfaction of the instructor in flat rate plus 20%.

NOTE 1: Job qualification performance standard - student can meet performance standards for 80% of primary tasks. Successful completion of this block (9.0), plus 0.0 and 3.0 result in qualification as an Automotive Heating and Air Conditioning Technician.

NOTE 2: Test item performance evaulation should also consider proper tools, materials, and equipment selection and use for task assigned and observance of safety precautions.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Automatic Transmissions Maintenance and Repair (Block 10.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently part of T & I No. 7393- Automotive Mechanics III.

Department of Community Colleges - Currently part of AUT 1124 - Auto Power Train Systems.

INSTRUCTIONAL CONTACT HOURS: High Schools: None.
(This course or block of instruction normally is not taught at the high school level, owing to a lack of instructional time, complexity of the item, and the equipment requirements.)
CC/TI: 165

INSTRUCTIONAL OBJECTIVES:

To provide the learner with the necessary occupational instruction and opportunity for practical application to develop the skills and knowledge necessary to qualify the learner to inspect, maintain, adjust, repair, or replace the automotive automatic transmission. Manufacturer's specifications and industry standards apply.

QUALIFICATIONS OR JOB SKILLS GAINED:

Successful completion of this block of instruction qualifies the learner to perform inspections, maintain, adjust, repair, or replace the automotive automatic transmission. With validation of this qualification by performance evaluation, using industry performance standards, the successful learner is considered to be qualified as an Automatic Transmission Technician [Light Repair].

PREREQUISITES:

High Schools: Not applicable.
Community College/Technical Institute: Block 0.0 (Introduction to Automotive Technology) and Block 7.0 (Power Train and Manual Transmission Maintenance and Repair), or evidence of knowledge based upon experience, verified by demonstrated performance evaluation.

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance, but also include a requirement for knowledge of related technical information. The test items are outline in nature and require specific data to complete the situation or problem, relate directly to the instructional objectives and are considered to be both valid and reliable.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program of instruction. Special equipment and tool requirements peculiar to this block are attached.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

AUTOMOTIVE TECHNOLOGY

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair

TASK NUMBER: 10.011 TITLE: Adjust Floor Shift Linkage.

INSTRUCTIONAL OBJECTIVE - 10.011: How to Adjust Floor Shift Linkage.

SKILLS: (Process Objectives)

10.0111 - How to make floor shift linkage adjustment.
10.0112 - How to make visual inspection.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Know purpose and operation.
- See parts identification manual.

REQUIRED INSTRUCTIONAL TIME: 10.011, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Linkage works properly to manufacturer's specifications.
- Demonstrates knowledge of operation of linkage to make visual inspection.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.012 TITLE: Adjust Linkage From Steering Column to Automatic Transmission.

INSTRUCTIONAL OBJECTIVE - 10.012: How to Adjust Linkage From Steering Column to Automatic Transmission.

SKILLS: (Process Objectives)

10.0121 - How to make steering column to transmission adjustment.
10.0122 - How to make visual inspection.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Know purpose and operation of component.
- See parts identification manual.

REQUIRED INSTRUCTIONAL TIME: 10.012, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Linkage works properly to manufacturer's specifications.
- Demonstrates knowledge of operation of linkage to make visual inspection.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.013 TITLE: Adjust Linkage From Engine to Automatic Transmission.

INSTRUCTIONAL OBJECTIVE - 10.013: How to Adjust Linkage From Engine to Automatic Transmission.

SKILLS: (Process Objectives)

10.0131 - How to make engine to automatic transmission linkage adjustment.
10.0132 - How to make visual inspection.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Know purpose and operation of component.
- See parts identification manual.

REQUIRED INSTRUCTIONAL TIME: 10.013, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Linkage works properly to manufacturer's specifications.
- Demonstrates knowledge of operation of linkage to make visual inspection.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.

TASK NUMBER: 10.02 TITLE: Clean and Visually Inspect Transmission.

INSTRUCTIONAL OBJECTIVE - 10.02: How to Clean and Visually Inspect Transmission.

SKILLS: (Process Objectives)

10.021 - How to make visual inspection.
10.022 - How to clean transmission.

RELATED TECHNICAL INFORMATION:

- Safety and operation of cleaning.
- See parts identification manual.

REQUIRED INSTRUCTIONAL TIME: 10.02, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Demonstrates knowledge of how to make visual inspection.
- Demonstrates knowledge of cleaning materials and chemicals.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.03 TITLE: Diagnose, Replace or Adjust Modulators.

INSTRUCTIONAL OBJECTIVE - 10.03: How to Diagnose, Replace or Adjust Modulators.

SKILLS: (Process Objectives)

10.031 - How to diagnose modulator troubles.
10.032 - How to replace or adjust modulators.

RELATED TECHNICAL INFORMATION:

- See parts identification manual.
- Manufacturer's specifications.
- Know purpose and operation.

REQUIRED INSTRUCTIONAL TIME: 10.03, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Demonstrates knowledge of modulator operation.
- Performs task in flat rate + 20% time.
- Knowledge of how to diagnose component.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.

TASK NUMBER: 10.04 TITLE: Service Filter and Check Transmission Cooling System.

INSTRUCTIONAL OBJECTIVE - 10.04: How to Service Filter and Check Transmission Cooling System.

SKILLS: (Process Objectives)

10.041 - How to service filters, clean and replace or change and replace.
10.042 - How to check transmission cooling system.

RELATED TECHNICAL INFORMATION:

- See parts identification manual.
- Manufacturer's specification.
- Know operation.

REQUIRED INSTRUCTIONAL TIME: 10.04, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Demonstrates knowledge of filters.
- Demonstrates knowledge of how to check cooling system.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.05 TITLE: Replace or Adjust Neutral Switch.

INSTRUCTIONAL OBJECTIVE - 10.05: How to Replace or Adjust Neutral Switch.

SKILLS: (Process Objectives)

10.051 - How to replace neutral safety switch.
10.052 - How to adjust neutral safety switch.

RELATED TECHNICAL INFORMATION:

- See parts identification manual.
- Manufacturer's specifications.
- Know purpose of component.

REQUIRED INSTRUCTIONAL TIME: 10.05, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Part works properly to manufacturer's specifications.
- Demonstrates knowledge of components and shop safety.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.06 TITLE: Make External Adjustment of Bands On Automatic Transmissions.

INSTRUCTIONAL OBJECTIVE - 10.06: How to Make External Adjustment of Bands on Automatic Transmissions.

SKILLS: (Process Objectives)

10.061 - How to make adjustment on external bands.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- Know purpose and operation of component.

REQUIRED INSTRUCTIONAL TIME: 10.06, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Adjusts bands to manufacturer's specifications.
- Demonstrates knowledge of proper use of required special tools.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.07 TITLE: Remove and Install Automatic Transmission.

INSTRUCTIONAL OBJECTIVE - 10.07: How to Remove and Install Automatic Transmission.

SKILLS: (Process Objectives)

10.071 - How to remove automatic transmission.
10.072 - How to clean after removed.
10.073 - How to install and adjust.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- See parts identification manual.

REQUIRED INSTRUCTIONAL TIME: 10.07, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Uses proper cleaning materials and chemicals.
- Installs correctly with no leaks.
- Unit works properly to manufacturer's specifications.
- Demonstrates knowledge of proper use of required special tools and shop safety.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.

TASK NUMBER: 10.08 TITLE: Remove and Replace External Seals, Gaskets, and Lines on Automatic Transmissions.

INSTRUCTIONAL OBJECTIVE - 10.08: How to Remove and Replace External Seals, Gaskets, and Lines on Automatic Transmissions.

SKILLS: (Process Objectives)

10.081 - How to remove and replace external seals, gaskets and lines.
10.082 - How to clean and replace.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- See parts identification manual.
- Know purpose and operation of components.

REQUIRED INSTRUCTIONAL TIME: 10.08, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Seals, gaskets and lines operate properly with no leaks.
- Demonstrates knowledge of proper use of required special tools.
- Demonstrates knowledge of cleaning tools.
- Shop safety observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.09 TITLE: Inspect and Remove and Replace Converter.

INSTRUCTIONAL OBJECTIVE - 10.09: How to Inspect and Remove and Replace Converter.

SKILLS: (Process Objectives)

10.091 - How to remove transmission converter.
10.092 - How to inspect and replace converter.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- See parts identification manual.
- Know theory and operation of component.

REQUIRED INSTRUCTIONAL TIME: 10.09, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Demonstrates knowledge of proper inspection procedures.
- Demonstrates knowledge of components and shop safety.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.10 TITLE: Inspect and Repair Front Pump and Components.

INSTRUCTIONAL OBJECTIVE - 10.10: How to Inspect and Repair Front Pump and Components.

SKILLS: (Process Objectives)

10.101 - How to remove front pump.
10.102 - How to inspect and repair front pump.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- See parts identification manual.
- Know operation of component.

REQUIRED INSTRUCTIONAL TIME: 10.10, 12 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Demonstrates knowledge of unit repairs and inspections to manufacturer's specifications.
- Shop safety is observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.11 TITLE: Make Internal Repairs and Adjustments on Automatic Transmissions.

INSTRUCTIONAL OBJECTIVE - 10.11: How to Make Internal Repairs and Adjustments on Automatic Transmissions.

SKILLS: (Process Objectives)

10.111 - How to make internal repairs and adjustments on automatic transmissions.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- See parts identification manual.
- Know operation of transmission.

REQUIRED INSTRUCTIONAL TIME: 10.11, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs task in flat rate + 20% time.
- Demonstrates knowledge of repairs and adjustments on automatic transmission to manufacturer's specifications.
- Shop safety is observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'

TASK NUMBER: 10.12 TITLE: Perform Operational Automatic Transmission Inspections.

INSTRUCTIONAL OBJECTIVE - 10.12: How to Perform Operational Automatic Transmission Inspections.

SKILLS: (Process Objectives)

10.121 - How to perform operational automatic transmission inspections.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- See parts identification manual.
- Know theory and operation of automatic transmission.

REQUIRED INSTRUCTIONAL TIME: 10.12, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Demonstrates knowledge of automatic transmission inspection procedures.
- Shop safety is observed.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmissions Maintenance & Repair (cont'd.)

TASK NUMBER: 10.13 TITLE: Rebuild Automatic Transmissions.

INSTRUCTIONAL OBJECTIVE - 10.13: How to Rebuild Automatic Transmissions.

SKILLS: (Process Objectives)

10.131 - How to rebuild automatic transmissions.
10.132 - How to use special transmission tools and equipment.

RELATED TECHNICAL INFORMATION:

- See manufacturer's specifications.
- See parts identification manual.
- Know theory and operation.
- Shop safety.

REQUIRED INSTRUCTIONAL TIME: 10.13, 75 hours.

REQUIRED PERFORMANCE STANDARDS:

- Knowledge of automatic transmissions.
- Flat rate + 20%.
- Shop safety.
- Knowledge of special tools.
- Unit works properly with no leaks.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission

Seal removers - sliding hammer type
Seal drivers
Hydraulic press with bearing collars
Pinion flange holder
Universal joint removal and installation tool
Pinion angle gauge
Clutch alignment tool
Shift linkage grommet tool
Manual transmission output shaft bearing removal and installation tool
Automatic transmission band adjuster wrench and adapters
Automatic transmission band adjuster
Wrench and spacer (intermediate bands FMX)
Automatic transmission clutch spring compressor tool
Torque converter cleaner & oil line cleaner
Transmission jack
Hand vacuum tester (replaces vacuum pump on distributor machine)
Parts washer
Converter leak checking tool
Converter Checking Tools
Dial indicator and support brackets
Air nozzle with rubber tip
Inch pound torque wrench
Special tools for particular transmission being serviced

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission Maintenance and Repair
(Automatic Transmission Fundamentals)

Related Technical Information. Multiple Choice - circle the correct answer.

1. The selector levers for most automatic transmissions have:

    a. four
    b. five
    c. six
    d. seven partitions

2. The selector-lever position in which there is no power flow through the transmission, but the locking effect is off, is:

    a. P
    b. D
    c. N
    d. R

3. The typical planetary gearset consists of planet pinions, a ring or internal gear, and:

    a. a sun gear
    b. pinions
    c. clutch
    d. brake band

4. The three actions of the planetary gears in an automatic transmission are to provide reverse, direct drive, and:

    a. high gear
    b. gear reduction
    c. gear increase

5. The two control mechanisms used with a planetary gear system are:

    a. valve and pump
    b. torque converter and sun gear
    c. bands and clutches

6. The brake band is actuated by a:

    a. servo
    b. clutch piston
    c. manual valve

7. The ring-shaped part in the clutch which puts the pressure on the clutch disks is called the:

    a. spring
    b. piston
    c. ring gear

8. The two controlling factors that cooperate to produce gear shifting are:

    a. hydraulic pressure and governor pressure
    b. car speed and governor pressure
    c. throttle opening and car speed

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission Maintenance and Repair
(Automatic Transmission Fundamentals) (cont'd.)

9. The bellows in the modulator valve is actuated by:

   a. intake-manifold vacuum
   b. car speed
   c. engine speed

10. The valve which is controlled by linkage to the selector lever is called the:

    a. shift valve
    b. manual valve
    c. shift control valve

TEST ANSWERS:

1. c
2. c
3. a
4. b
5. c
6. a
7. b
8. c
9. a
10. b

Performance Standards: 80% correct responses required when five or more of above test items are used.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission Maintenance and Repair

TASK

10.011 The student will adjust floor shift linkage per manufacturer's specifications to satisfaction of the instructor in flat rate plus 20%.

10.012 The student will adjust linkage from steering column to automatic transmission per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.013 The student will adjust linkage from engine to automatic transmission per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.02 The student will demonstrate knowledge how to clean and visually inspect transmission to satisfaction of instructor in flat rate plus 20%.

10.03 The student will diagnose, replace or adjust modulator per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.04 The student will service filter and check transmission cooling system per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.05 The student will replace or adjust neutral switch per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.06 The student will make external adjustment of bands on automatic transmissions per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.07 The student will demonstrate knowledge of proper way to remove and install automatic transmission to satisfaction of instructor.

10.08 The student will remove and replace external seals, gaskets and lines on automatic transmission per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.09 The student will inspect and remove and replace converter per manufacturers specifications to satisfaction of instructor in flat rate plus 20%.

TASK

10.10 The student will inspect and repair front pump components per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.11 The student will make internal repairs and adjustments on automatic transmission per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

10.12 The student will demonstrate the knowledge of how to perform operational automatic transmission inspection to satisfaction of instructor.

10.13 The student will rebuild an automatic transmission per manufacturer's specifications to satisfaction of instructor in flat rate plus 20%.

Note 1: Job qualification performance standard - student can meet performance standards for 80%. Successful completion of this block (10.0) plus 0.0 and 7.0 result in qualification as an Automatic Transmission Technician (Light Repair).

Note 2: Test item performance evaluation should also consider selection of proper tools, materials, and equipment for assigned task and observance of safety precautions.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission Maintenance and Repair (Chrysler Torqueflite)

Related Technical Information. Multiple Choice - circle the correct answer.

1. Counting all the active control members in the transmission, including the clutches and bands, we find that there are:

   a. four
   b. five
   c. six

2. The compound planetary gear system has two sets of planetary pinions, two internal or ring gears, and:

   a. three sun gears
   b. two sun gears
   c. one sun gear

3. The front clutch is connected by a driving shell to the:

   a. output shaft
   b. rear ring gear
   c. sun gear

4. In D range on breakaway in first gear, the overrun clutch holds and the:

   a. front clutch is engaged
   b. rear clutch is engaged
   c. kickdown band is applied

5. In D range in second gear, the overrun clutch overruns, the rear clutch is engaged, and the:

   a. front clutch is engaged
   b. rear band is applied
   c. front band is applied

6. In direct drive, the overrun clutch overruns, both clutches are engaged, and:

   a. the front band is applied
   b. the rear band is applied
   c. both bands are released

7. In second range, second gear, the overrun clutch overruns, the kickdown or front band is applied, and the:

   a. rear clutch is engaged
   b. rear band is applied
   c. front clutch is engaged

8. In low range, low gear, the rear band is applied and the:

   a. front clutch is engaged
   b. front band is applied
   c. rear clutch is engaged

9. In reverse, the rear band is applied and the:

   a. rear clutch is engaged
   b. front clutch is engaged
   c. front band is applied

10. The sun gear is locked in a stationary position by:

    a. front-clutch engagement
    b. front-band application
    c. rear-band application

11. Three diagnostic tests are to be made on the Torqueflite: oil pressure, stall, and:

    a. hydraulic control
    b. shift point
    c. air pressure

12. To check the performance of the torque-converter stator clutch and the transmission clutches, give the transmission the:

    a. pressure test
    b. air-pressure test
    c. stall test

13. Stall speed more than 200 rpm above specifications indicates:

    a. poorly tuned engine
    b. clutch slippage
    c. band slippage

14. Stall speed 250 to 300 rpm below specifications indicates:

    a. torque-converter clutch slippage
    b. transmission clutch slippage
    c. brake-band slippage

15. Rear-servo apply pressure, as compared with line pressure in D, should be:

    a. higher
    b. about the same
    c. lower

16. The fluid pressure checks to be made include line pressure, kickdown-servo release pressure, lubrication pressure, and:

    a. clutch release pressure
    b. rear-servo apply pressure
    c. rear-servo release pressure

17. The two pressure adjustments that can be made are to line pressure and:

    a. servo apply pressure
    b. throttle pressure
    c. clutch apply pressure

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission Maintenance and Repair (Chrysler Torqueflite) (cont'd.)

18. In the air-pressure tests, you check the actions of the:

    a. servos and clutches
    b. valves and pump
    c. servos and linkages

19. In addition to the pressure adjustments, other adjustments to be made include throttle-rod linkage:

    a. gearshift linkage and clutches
    b. throttle opening and gearshift linkage
    c. gearshift linkage and brake band

20. If clutches and servos work properly but shifting is incorrect, the trouble is probably in the:

    a. pump
    b. valve body
    c. linkages

21. To attach the converter to the drive plate during installation of the transmission, turn the drive plate with:

    a. a wrench
    b. the cranking motor
    c. the output shaft

22. For normal service in all but the hemi engine, the recommendation on oil changes is:

    a. do not change oil
    b. change every 12,000 miles
    c. change every 24,000 miles

23. The purpose of the air-pressure tests is to find out whether or not the:

    a. pressures are sufficient
    b. clutches and servos work
    c. linkages are adjusted

24. To remove the governor, you first have to remove the:

    a. valve body
    b. extension housing
    c. converter

25. Drive and play is checked by moving the:

    a. output shaft in and out
    b. torque converter back and forth
    c. input shaft in and out

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission Maintenance and Repair
(Chrysler Torqueflite) (cont'd.)

TEST ANSWERS:

1. b
2. c
3. c
4. b
5. c
6. c
7. a
8. c
9. b
10. b
11. c
12. c
13. b
14. a
15. a
16. b
17. a
18. c
19. b
20. b
21. b
22. a
23. b
24. b
25. c

Performance Standards: 80% correct responses required when five or more test items are used.

BLOCK OR DIVISION NUMBER: 10.0 TITLE: Automatic Transmission Maintenance and Repair
(Torque Converter)

Related Technical Information. Multiple Choice - circle the correct answer.

1. If a liquid is put under pressure, it will:

   a. compress
   b. not compress
   c. increase volume

2. Since a liquid is incompressible, it can be used to transmit:

   a. motion and pressure
   b. rotation and speed
   c. vacuum and heat

3. Which element creates reaction in a torque converter?

   a. impeller
   b. turbine
   c. stator

4. Torque multiplication in a torque converter is greater at what speed?

   a. low speed
   b. cruising speed
   c. high speed

5. Modern torque converters utilize:

   a. an engine-driven turbine
   b. a fluid-driven turbine
   c. a stator
   d. all of the above
   e. none of the above

6. The purpose of the cup-shaped blades in a torque converter is:

   a. to drive the impeller
   b. to cool the oil
   c. to smooth the oil
   d. to multiply torque

7. Another name used to describe a stator is:

   a. turbine
   b. impeller
   c. reactor
   d. housing

8. The purpose of the fluid coupling is to act as a:

   a. synchronizing device
   b. automatic gear changer
   c. flexible power-transmitting coupling

Test Items (Con't)

9. The fluid coupling consists essentially of two:

   a. doughnuts
   b. vaned members
   c. guide rings
   d. driving shafts

10. In the fluid coupling, oil passes from the driving member to the:

    a. coupling
    b. vanes
    c. driven member
    d. gear

11. The purpose of the guide ring in the fluid coupling is to reduce oil:

    a. movement between members
    b. turbulence
    c. level in coupling

12. The fluid coupling has maximum efficiency when the driving and driven members are turning:

    a. at high speed
    b. at low speed
    [illegible] at different speeds
    [illegible] at about the same speed

Performance Standards: 80% correct responses required when five or more above test items are used.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-03)
(DPI - High Schools - N/A)

COURSE: Automotive Electrical Systems Maintenance and Repair (Block 11.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently covered in part in
T & I No. 7[illegible]3 - Automotive Engine Tune-up III and
T & I No. 7393 - Automotive Mechanics III

Department of Community Colleges - Currently part of
AUT 1102 - Engine Electrical and Fuel Systems and
PME 1202 - Auto Electrical and Electronic Systems

INSTRUCTIONAL CONTACT HOURS: High Schools: 125 (Includes Engine Electrical System and running lights only.)
Comm. Coll./Tech. Inst.: 231*
(*NOTE: Additional instructional time provided in Block 12.0 - Automotive Servicing.)

INSTRUCTIONAL OBJECTIVES:

High Schools: To provide the learner with the necessary occupational instruction and opportunity for practical application to develop the skills and knowledge necessary to qualify the learner to inspect, maintain, repair, or replace only the automotive engine electrical system, the battery, and replace bulbs and fuses of the light system. (NOTE: The instructional objectives of this block for the high schools is limited by the time available and the extreme complexity of much of the subject matter.) This instruction is used primarily in conjunction with Block 8.0.

Comm. Coll./Tech. Inst.: To provide the learner with the necessary occupational instruction and opportunity for practical application to develop the skills and related technical knowledge necessary to qualify the learner to inspect, maintain, repair, or replace all components of the automotive electrical system.

QUALIFICATIONS OR JOB SKILLS GAINED:

High Schools: Successful completion of that portion of the block of instruction conducted in the high schools does not provide a qualification recognized by the industry in the electrical system. The learner is qualified to work on the engine starting, charging, and ignition system which is coupled with the instruction conducted in Block 8.0 to qualify the successful learner as an Automotive Engine Repair Technician.

Comm. Coll/.Tech Inst.: Successful completion of the total block of instruction qualifies the learner to inspect, maintain, repair, or replace all components of the automotive electrical system. With validation of this qualification by performance evaluation, using industry performance standards, the successful learner is qualified as an Automotive Electrical Systems Technician.

PREREQUISITES:

High Schools and post-secondary schools: Block 0.0 (Introduction to Automotive Technology) or evidence of knowledge based upon experience, verified by a demonstrated performance evaluation.

PERFORMANCE EVALUATION:

Test items for end of course evaluation for job or advanced instruction qualification are provided. These test items emphasize demonstrated performance, but also include knowledge of related technical information. Test items are outline in nature and require specific data to complete the situation or problem, relate directly to the instructional objective, and are considered to be both valid and reliable.

EQUIPMENT REQUIREMENTS:

The general equipment list is attached to the last block of this program of instruction. Special equipment and tool requirements peculiar to this block are attached.

ARTICULATION RESEARCH PROJECT
OCCUPATIONAL TASKS AND INSTRUCTIONAL REQUIREMENTS

Automotive

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair

TASK NUMBER: 11.01 TITLE: Clean, Gap, and Test Spark Plugs.

INSTRUCTIONAL OBJECTIVE - 11.01: How to Clean, Gap, and Test Spark Plugs.

SKILLS: (Process Objectives)

11.011 - How to clean, gap, and test spark plugs.

RELATED TECHNICAL INFORMATION:

- Use of spark plug equipment.
- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 11.01, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Cleans, gaps, and tests spark plugs according to manufacturer's specifications.
- Flat rate + 20%.
- Uses 8 pack plug cleaning and testing equipment correctly and carefully with speed and accuracy.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.02 TITLE: Replace Light Bulbs.

INSTRUCTIONAL OBJECTIVE - 11.02: How to Replace Light Bulbs.

SKILLS: (Process Objectives)

11.021 - How to replace light bulbs.
11.022 - How to check light bulbs.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Types of light bulbs.

REQUIRED INSTRUCTIONAL TIME: 11.02, 3 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces light bulbs properly according to manufacturer's specifications
- Flat rate + 20%.
- Checks light bulbs correctly and carefully.
- Uses proper type of bulbs.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.03 TITLE: Replace Flasher Units.

INSTRUCTIONAL OBJECTIVE - 11.03: How to Replace Flasher Units.

SKILLS: (Process Objectives)

11.031 - How to replace flasher units.
11.032 - How to check flasher units.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Types of flasher units.

REQUIRED INSTRUCTIONAL TIME: 11.03, 1 hour.

REQUIRED PERFORMANCE STANDARDS:

- Replaces flasher unit properly according to manufacturer's specifications.
- Flat rate + 20%.
- Checks flasher units correctly and uses proper type of flasher units.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.04 TITLE: Test, Inspect, Service or Replace Batteries, Cables, and Battery Boxes.

INSTRUCTIONAL OBJECTIVE - 11.04: How to Test, Inspect Service or Replace Batteries, Cables, and Battery Boxes.

SKILLS: (Process Objectives)

041
11.042 - How to service or replace batteries, cables, and battery boxes.
11.043 - How to use special tools and equipment.
11.041 - How to test and inspect batteries, cables & battery boxes,

RELATED TECHNICAL INFORMATION:

- Required special equipment and tools.
- Manufacturer's specifications.
- Special problems related to battery acid.

REQUIRED INSTRUCTIONAL TIME: 11.04, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Services and replaces batteries, cables, and battery boxes according to manufacturer's specifications.
- Flat rate + 20%.
- Uses special tools and equipment correctly and very carefully with speed and accuracy.
- Performs battery testing and inspection according to appropriate service manual and manufacturer's specifications

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.05 TITLE: Perform Operational Inspections of Lighting and Electrical Systems.

INSTRUCTIONAL OBJECTIVE - 11.05: How to Perform Operational Inspections of Lighting and Electrical Systems.

SKILLS: (Process Objectives)

11.051 - How to perform operational inspections of lighting and electrical systems.
11.052 - How to use electrical test eqipment.
11.053 - How to diagnose electrical circuits.

RELATED TECHNICAL INFORMATION:

- Required electrical test equipment.
- Manufacturer's specifications.
- Steps in diagnosis of electrical circuits.

REQUIRED INSTRUCTIONAL TIME: 11.05, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Performs operational inspections of lighting and electrical systems, according to manufacturer's specification.
- Diagnoses electrical circuits using proper test equipment to obtain proper operation, according to manufacturer's specification.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.06 TITLE: Remove and Replace Stop-Light Switch.

INSTRUCTIONAL OBJECTIVE - 11.06: How to Remove and Replace Stop-Light Switch.

SKILLS: (Process Objectives)

11.061 - How to remove and replace stop-light switch.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 11.06, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces stop light switch correctly, according to manufacturer's specifications.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repairs (cont'd.)

TASK NUMBER: 11.07 TITLE: Adjust Headlights.

INSTRUCTIONAL OBJECTIVE - 11.07: How to Adjust Headlights.

SKILLS: (Process Objectives)

11.071 - How to adjust headlights,

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- State regulations on headlights.

REQUIRED INSTRUCTIONAL TIME: 11.07, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Adjusts headlights according to manufacturer's specifications, in-keeping with state regulations on headlights.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'
Maintenance and Repair

TASK NUMBER: 11.08 TITLE: Adjust, Remove, Repair, or Replace Back-Up Light Switches.

INSTRUCTIONAL OBJECTIVE - 11.08: How to Adjust, Remove, Repair, or Replace Back-Up Light Switches.

SKILLS: (Process Objectives)

11.081 - How to adjust back-up light switch.
11.082 - How to remove and replace back-up light switch.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 11.08, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Adjusts, replaces or repairs back-up light switch, according to manufacturer's specifications.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.09 TITLE: Set Ignition Timing.

INSTRUCTIONAL OBJECTIVE - 11.09: How to Set Ignition Timing.

SKILLS: (Process Objectives)

11.091 - How to set ignition timing.
11.092 - How to use timing light.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Function of timing light.

REQUIRED INSTRUCTIONAL TIME: 11.09, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Sets ignition timing correctly, according to manufacturer's specifications.
- Flat rate + 20%.
- Uses timing light correctly with speed and accuracy.
- Observes safety precautions.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd
Maintenance and Repair

TASK NUMBER: 11.10 TITLE: Remove and Replace Generators or Alternators.

INSTRUCTIONAL OBJECTIVE - 11.10: How to Remove and Replace Generators or Alternators.

SKILLS: (Process Objectives)

11.101 - How to remove and replace generators.
11.102 - How to use tension gauge.
11.103 - How to remove and replace alternators.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Function of tension gauge.
- Electrical generator theory.
- Operation of an alternator.

REQUIRED INSTRUCTIONAL TIME: 11.10, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces generators correctly, according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper steps in checking generators or alternators and belt tension.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.11 TITLE: Remove and Replace Starters.

INSTRUCTIONAL OBJECTIVE - 11.11: How to Remove and Replace Starters.

SKILLS: (Process Objectives)

11.111 - How to remove and replace starters.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 11.11, 3 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces starters correctly according to manufacturer's specifications.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.12 TITLE: Repair Starters and Solenoids.

INSTRUCTIONAL OBJECTIVE - 11.12: How to Repair Starters and Solenoids.

SKILLS: (Process Objectives)

11.121 - How to repair starters.
11.122 - How to use special tools and equipment.
11.123 - How to repair solenoids.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Required special tools and equipment.
- Electric motor operation.
- Solenoid purpose and construction.

REQUIRED INSTRUCTIONAL TIME: 11.12, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Repairs starters and solenoids using special tools and equipment properly according to manufacturer's specifications.
- Flat rate + 20%.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.13 TITLE: Repair Generators or Alternators.

INSTRUCTIONAL OBJECTIVE - 11.13: How to Repair Generators or Alternators.

SKILLS: (Process Objectives)

11.131 - How to repair generators.
11.132 - How to use special tools and equipment.
11.133 - How to repair alternators.
11.134 - How to use special tools and equipment.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Required special equipment and tools.

REQUIRED INSTRUCTIONAL TIME: 11.13, 13 hours.

REQUIRED PERFORMANCE STANDARDS:

- Repairs generators or alternators, using proper tools and equipment, according to manufacturer's specifications.
- Flat rate + 20%.
- Uses knowledge of automotive generator system theory to obtain speed and accuracy.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.14 TITLE: Repair or Remove and Replace Charging System Regulators.

INSTRUCTIONAL OBJECTIVE - 11.14: How to Repair or Remove and Replace Charging System Regulators.

SKILLS: (Process Objectives)

11.141 - How to remove and replace charging system regulators.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Operation and purpose of regulator.

REQUIRED INSTRUCTIONAL TIME: 11.14, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces charging system regulators properly according to manufacturer's specifications.
- Flat rate + 20%.
- Has and uses operational knowledge of charging system.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.15 TITLE: Analyze Malfunctions in the Cranking System.

INSTRUCTIONAL OBJECTIVE - 11.15: How to Analyze Malfunctions in the Cranking System.

SKILLS: (Process Objectives)

11.151 - How to analyze malfunctions in the cranking system.
11.152 - How to use starter battery tester.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Function of starter battery.

REQUIRED INSTRUCTIONAL TIME: 11.15, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Analyzes malfunctions in the cranking system correctly, according to manufacturer's specifications.
- Uses proper battery testing equipment correctly for testing cranking system.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd
Maintenance and Repair

TASK NUMBER: 11.16 TITLE: Remove, Repair, Replace and Adjust Distributor.

INSTRUCTIONAL OBJECTIVE - 11.16: How to Remove, Repair, Replace and Adjust Distributor.

SKILLS: (Process Objectives)

11.161 - How to remove and replace distributor.
11.162 - How to repair distributors.
11.163 - How to use distributor tester.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Function of distributor tester.

REQUIRED INSTRUCTIONAL TIME: 11.16, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes, repairs, replaces, or adjusts distributor correctly, according to manufacturer's specifications.
- Flat rate + 20%.
- Uses distributor testing equipment to insure correct operation.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.17 TITLE: Remove and Replace Turn Signal Switches.

INSTRUCTIONAL OBJECTIVE - 11.17: How to Remove and Replace Turn Signal Switches.

SKILLS: (Process Objectives)

11.171 - How to remove and replace turn signal switches.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 11.17, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces turn signal switches correctly according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper testing techniques to insure correct operation.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.18 TITLE: Remove and Repair Windshield Wiper Mechanisms or Controls.

INSTRUCTIONAL OBJECTIVE - 11.18: How to Remove and Repair Windshield Wiper Mechanisms or Controls.

SKILLS: (Process Objectives)

11.181 - How to remove and replace windshield wiper motors and switches.
11.182 - How to repair windshield wiper motors.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Steps in the diagnosis of electrical circuits.
- Parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 11.18, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and repairs windshield wiper mechanisms or controls according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper steps in the diagnosis of electrical circuits and uses parts manual for correct components identification.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.19 TITLE: Remove and Replace Fuse Block Assembly.

INSTRUCTIONAL OBJECTIVE - 11.19: How to Remove and Replace Fuse Block Assembly.

SKILLS: (Process Objectives)

11.191 - How to remove and replace fuse block assembly.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Parts manual for parts identification.
- Function of fuses.

REQUIRED INSTRUCTIONAL TIME: 11.19, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces fuse block assembly correctly according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper fuses and parts manual for correct identification.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.20 TITLE: Remove and Replace Chassis and Under-Hood Wiring.

INSTRUCTIONAL OBJECTIVE - 11.20: How to Remove and Replace Chassis and Under-Hood Wiring.

SKILLS: (Process Objectives)

11.201 - How to remove and replace wiring harness.
11.202 - How to diagnose electrical circuits.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Parts manual for parts identification.
- Steps in the diagnosis of electrical circuits.

REQUIRED INSTRUCTIONAL TIME: 11.20, 25 hours.

REQUIRED PERFORMANCE STANDARDS:

- Removes and replaces chassis and underhood wiring, according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper steps in the diagnosis of electrical circuits and refers to parts manual for circuitry component identification.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.21 TITLE: Test and Re-Wire Dash Units.

INSTRUCTIONAL OBJECTIVE - 11.21: How to Test and Re-Wire Dash Units.

SKILLS: (Process Objectives)

11.211 - How to test dashboard units.
11.212 - How to re-wire dash units.

RELATED TECHNICAL INFORMATION:

- Steps in the diagnosis of electrical circuits.
- Parts manual for parts identification.
- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 11.21, 8 hours.

REQUIRED PERFORMANCE STANDARDS:

- Tests and rewires dash units properly according to manufacturer's specification.
- Flat rate + 20%.
- Uses proper steps in the diagnosis of electrical circuits and uses parts manual for circuitry component identification.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd) Maintenance and Repair

TASK NUMBER: 11.22 TITLE: Test and Repair Automatic Alarm Systems of Safety Items.

INSTRUCTIONAL OBJECTIVE - 11.22: How to Test and Repair Automatic Alarm Systems of Safety Items.

SKILLS: (Process Objectives)

11.221 - How to test and repair automatic alarm systems of safety items.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Parts identification.
- Steps in the diagnosis and repair of electrical circuits.

REQUIRED INSTRUCTIONAL TIME: 11.22, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Tests and repairs automatic alarm system of safety items according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper steps in the diagnosis and repair of electrical circuits and uses parts manual for circuitry identification.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.23 TITLE: Test and Repair Cruise Control Units.

INSTRUCTIONAL OBJECTIVE - 11.23: **How to Test and Repair Cruise Control Units.**

SKILLS: (Process Objectives)

11.231 - How to test and repair cruise control units.
11.232 - How to use special electrical equipment.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Parts manual.
- Requirements to test electrical components and circuits.
- Required special electrical equipment.

REQUIRED INSTRUCTIONAL TIME: 11.23, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Tests and repairs cruise control units properly according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper testing equipment and parts manual for identification of parts.
- Uses correct steps, in proper sequence, in performing electrical checks.

BLOCK OF DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.24 TITLE: Evaluate Alternator, Generator and Regulator Output.

INSTRUCTIONAL OBJECTIVE - 11.24: How to Evaluate Alternator, Generator and Regulator Output.

SKILLS: (Process Objectives)

11.241 - How to evaluate alternator, generator and regulator output.
11.242 - How to use special electrical test equipment.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Know steps in test of electrical components.
- Required special electrical test instruments.

REQUIRED INSTRUCTIONAL TIME: 11.24, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Evaluates alternator, generator and regulator output according to manufacturer's specifications.
- Flat rate + 20%.
- Uses required special testing equipment accurately.
- Uses proper steps, in correct sequence, in performing electrical checks.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair (cont'd.)

TASK NUMBER: 11.251 TITLE: Analyze or Adjust Engine Performance Using Engine Analyzer.

INSTRUCTIONAL OBJECTIVE - 11.251: How to Analyze or Adjust Engine Performance Using Engine Analyzer.

SKILLS: (Process Objectives)

11.2511 - How to analyze or adjust engine performance using engine analyzer.
11.2512 - How to use engine analyzer.
11.2513 - How to use special tools.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Function of the engine analyzer.
- Required hand tools.

REQUIRED INSTRUCTIONAL TIME: 11.251, 30 hours.

REQUIRED PERFORMANCE STANDARDS:

- Analyzes and adjusts engine performance, using engine analyzer properly, according to manufacturer's specifications.
- Flat rate + 20%.
- Uses necessary tools and takes correct steps, in proper sequence, in using engine analyzer to insure proper engine operation.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.) Maintenance and Repair

TASK NUMBER: 11.252 TITLE: Inspect and Test Secondary Circuit Leads, Plug Wires, Distributor Cap, and Rotor.

INSTRUCTIONAL OBJECTIVE - 11.252: How to Inspect and Test Secondary Circuit Leads, Plug Wires, Distributor Cap, and Rotor.

SKILLS: (Process Objectives)

11.2521 - How to inspect and test secondary circuit leads, plug wires, distributor cap, and rotor.
11.2522 - How to use required electrical test instrument.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Required electrical test instruments

REQUIRED INSTRUCTIONAL TIME: 11.252, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects and tests secondary circuit leads, plug wires, distributor cap, and rotor properly according to manufacturer's specifications.
- Uses required electrical test equipment and takes necessary steps in correct sequence in checking procedure.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.253 TITLE: Inspect and Repair Ignition Switch, Resistor, Wiring, Coil, Points, and Condenser of the Primary Circuit.

INSTRUCTIONAL OBJECTIVE - 11.253: How to Inspect and Repair Ignition Switch, Resistor, Wiring, Coil, Points, and Condenser of the Primary Circuit.

SKILLS: (Process Objectives)

11.2531 - How to inspect and repair ignition switch, resistor, wiring, coil, points, and condenser of the primary circuit.
11.2532 - How to use special tools and electrical test equipment.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Required special electrical test equipment.
- Required hand tools.
- Parts manual for parts identification.

REQUIRED INSTRUCTIONAL TIME: 11.253, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Inspects and repairs ignition switch, resistor, wiring, coil, points and condenser of the primary circuit properly according to manufacturer's specifications.
- Flat rate + 20%.
- Uses proper tools and electrical test equipment.
- Takes necessary steps, in proper sequence, in testing procedure.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (Cont'd.)
Maintenance and Repair

TASK NUMBER: 11.254 TITLE: Locate and Repair Shorts and Open Circuits in Wiring.

INSTRUCTIONAL OBJECTIVE - 11.254: How to Locate and Repair Shorts and Open Circuits in Wiring.

SKILLS: (Process Objectives)

11.2541 - How to locate and repair shorts and open circuits in wiring.

RELATED TECHNICAL INFORMATION:

- Steps in testing electrical components and circuits.
- Parts Manual.
- Manufacturer's specifications.

REQUIRED INSTRUCTIONAL TIME: 11.254, 10 hours.

REQUIRED PERFORMANCE STANDARDS:

- Locates and repairs shorts and open circuits in wiring according to manufacturer's specifications.
- Flat rate + 20%.
- Takes necessary steps, in proper sequence, in testing electrical components and circuits.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems, Maintenance and Repair.
TASK NUMBER: 11.255 TITLE: Test, Service, Repair or Replace Components of Electronic Ignition.
INSTRUCTIONAL OBJECTIVE - 11.255: How to Test, Service, Repair or Replace Components of Electronic Ignition.

SKILLS: (Process Objectives)

How to:

11.2551 - Test electronic ignitions.
11.2552 - Service electronic ignitions.
11.2553 - Repair electronic ignitions.
11.2554 - Remove and replace electronic ignitions.

RELATED TECHNICAL INFORMATION:

- Operation of electronic ignitions.
- Service manuals.
- Diagnostic procedures.
- Manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TIME: 11.255, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Knows operation principles of electronic ignition.
- Can perform tests according to service manual.
- Performs service replacement or repair according to manufacturer's specifications.
- Performs task in Flat Rate plus 20% time.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems (cont'd.)
Maintenance and Repair

TASK NUMBER: 11.26 TITLE: Perform Complete Engine Tune-Up.

INSTRUCTIONAL OBJECTIVE - 11.26: How to Do a Complete Engine Tune-Up.

SKILLS: (Process Objectives)

11.261 - How to do a complete engine tune-up.
11.262 - How to use special electrical test equipment.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Parts manual.
- Required special electrical equipment.
- Required hand tools.

REQUIRED INSTRUCTIONAL TIME: 11.26, 50 hours.

REQUIRED PERFORMANCE STANDARDS:

- Completes engine tune-up to vehicle standards according to manufacturer's specifications.
- Flat rate + 20%.
- Uses required special equipment and hand tools and takes necessary precautions in engine tune-up procedure to insure proper engine operation.
- Uses parts manual for correct parts identification.

AUTOMOTIVE TECHNOLOGY

Special Tools and Equipment

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Electrical Systems Maintenance and Repair

Soldering gun
Self powered test lite
Non powered test lite
Voltmeter
Wire stripper and crimping tool
Wire cutter
Fuse extractor
Bulb extractor
Electrical system tester
Ammeter (Battery - Alternator - Regulator - Starting Circuit Tester)
Ohmmeter (Wide Range)
Fuel gauge system tester
Distributor test machine
Infra-red emission analyzer
Timing light
Battery charger
Hand operated vacuum tester
Crankcase ventilation tester
Hydrometer - battery
Compression gauge set
Fuel pump pressure and vacuum tester
Engine analyzer
Dwell meter and tachometer
Charging system, battery and starter tester
Engine/electrical system analyzer
Speed control analyzer
Body electrical system analyzer
Headlight Aiming Kit

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Electrical System (Battery)

TASKS:

11.04 1. List three rules associated with battery safety.

a.

b.

c.

2. Define the following terms:

a. specific gravity--

b. hydrometer--

3. The student should demonstrate the ability to perform the following jobs to the satisfaction of the instructor.

a. Clean and service a battery.
b. Remove and replace a battery.
c. Check a battery with a hydrometer.

TEST ANSWERS:

1. a. Battery electrolyte must not be allowed to spill or come in contact with eyes, skin, clothing or car paint.

b. Keep flames or sparks away from battery as it gives off very explosive gases.

c. Avoid shorting or grounding battery during service or removal.

2. a. Specific gravity--The weight of a solution compared to distilled water that has a reading of 1.000.

b. Hydrometer--Measures specific gravity of electrolyte.

3. Performance skills will be evaluated by the instructor to determine ability of student to meet established performance standards.

NOTE: Established performance standards include manufacturer's specifications and flat rate plus 20%.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Automotive Electrical Systems Maintenance and Repair.

The student should demonstrate the ability to perform the following jobs and meet job qualifications performance standards. (Manufacturer's specifications and flat rate plus 20%.)

TASK

11.02 Replace light bulbs.

11.03 Replace flasher units.

11.05 Perform operational inspections of lighting and electrical systems.

11.06 Remove and replace stop-light switch.

11.07 Adjust headlights.

11.08 Adjust, remove, repair, or replace back-up light switches.

11.11 Remove and replace starters.

11.12 Repair starters and solenoids.

11.17 Remove and replace turn signal switches.

11.18 Remove and repair windshield wiper mechanisms or controls.

11.19 Remove and replace fuse block assembly.

11.20 Remove and replace chassis and under-hood wiring.

11.21 Test and rewire dash units.

11.22 Test and repair automatic alarm systems of safety items.

11.23 Test and repair cruise control units.

NOTE: Student must be able to meet required performance standards for at least 80% of the tasks of the block of instruction (11.0) and successfully complete at least Block 0.0 to be qualified as an Automotive Electrical Systems Technician.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Electrical System (Ignition System)

TASKS:

11.01
11.09
11.16
11.252
11.253
11.254
11.255
11.26

1. Discuss in writing the operation of the ignition system beginning with the battery through one complete cycle.

2. The student should demonstrate the ability to perform the following jobs to the satisfaction of the instructor:

   a. Remove and replace a distributor.
   b. Remove and replace contact points and condensor.
   c. Adjust dwell on an externally adjustable distributor.
   d. Check ignition timing.
   e. Remove, service, and replace spark plugs.

TEST ANSWERS:

1. Answer should contain the following points:

   a. With the ignition switch on and the contact points closed, low voltage current flows from the battery through the primary winding of the coil and through the contact points to ground.

   b. The flow of low voltage current through the primary windings of the coil causes a magnetic field buildup.

   c. As the contact points open, current continues to flow across the point surfaces; the condensor attached to the points absorbs this flow of current.

   d. Stopping this flow of current causes the magnetic field of the coil to collapse across the secondary coil windings, causing a high voltage surge.

   e. This high voltage surge is directed from the secondary windings of the coil through the distributor cap and rotor and on to the spark plug to ground.

2. Performance skills will be evaluated by the instructor based upon established performance standards for instructional objective concerned.

   NOTE: Established performance standards include manufacturer's specifications and flat rate plus 20%.

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Electrical System (Charging Sub-system)

TASKS:

11.10
11.13
11.14
11.24

1. Identify the parts of an alternator shown below.

   a. ______________________________

   b. ______________________________

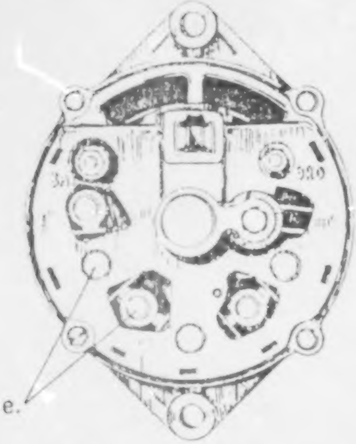
   c. ______________________________

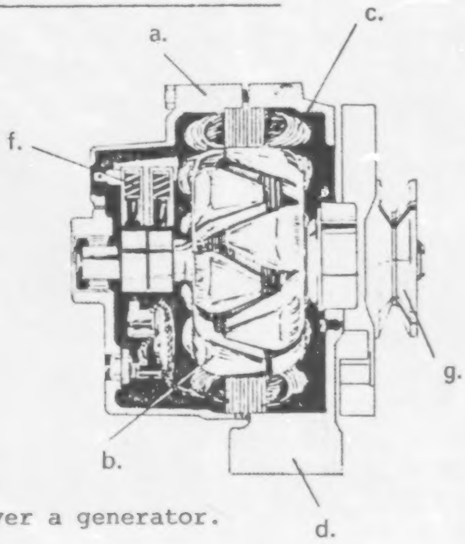
   d. ______________________________

   e. ______________________________

   f. ______________________________

   g. ______________________________





2. List two advantages of an alternator over a generator.

   a.

   b.

3. The student should demonstrate the ability to perform the following jobs and meet job qualification performance standards.

   a. Remove and replace a generator.
   b. Disassemble, check, and reassemble a generator.
   c. Remove and replace an alternator.
   d. Disassemble, check, and reassemble an alternator.

TEST ITEMS

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Electrical System (Starter)

TASK	
11.01 11.05 11.15 11.16 11.21 11.22 11.23 11.24 11.251 11.252 11.253 11.254	Given an inoperative, standard, major assembly component of an automotive electrical system, the student will inspect and test to determine the trouble according to the manufacturer's specifications and state or take the appropriate corrective action.

TEST ANSWERS

TASK 11.12

a. Thru Bolts

b. End Frame

c. Starter Brushes

d. Starter Frame

e. Armature

f. Starter Drive

g. Drive Housing

h. Shift Lever

i. Solenoid

j. Bushings

k. Field Coil

l. Commutator

TASK	
11.01 11.05 11.15 11.16 11.21 11.22 11.23 11.24 11.251 11.252 11.253 11.254	Performance Standards: Student selects proper tools and equipment for job. Follows inspection sequence prescribed in the manufacturer's specifications and observes safety precautions. Uses tools and equipment correctly. Identifies the trouble correctly and states (or takes if directed by instructor/teacher) the appropriate corrective action. Performs task in Flat Rate plus 20%, to the satisfaction of instructor.

NOTE: Performance Standards for non-performance related technical information test items - 80% correct responses required when five or more test items are used or test item has five or more parts.

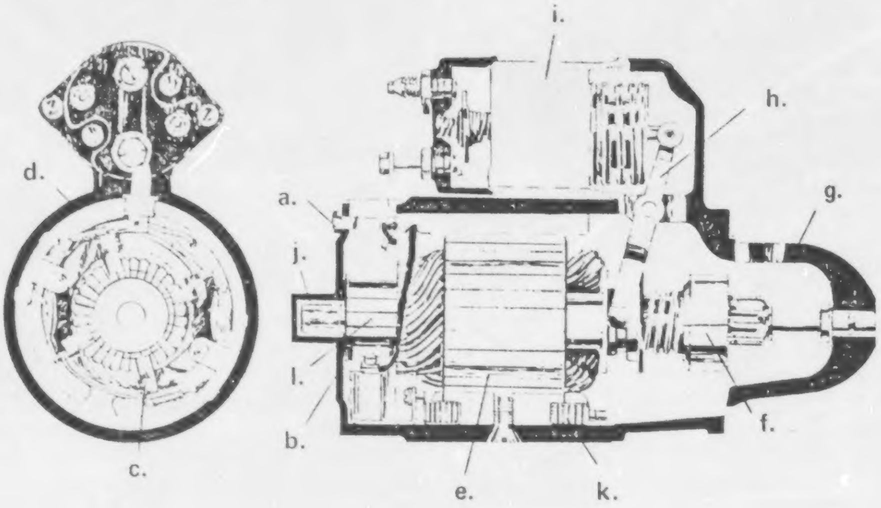
TEST ITEMS

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Electrical System (Starter)

Identify the parts of the starter shown below and state purpose of each.

TASK

11.12



	PART NAME		PURPOSE
a.		a.	
b.		b.	
c.		c.	
d.		d.	
e.		e.	
f.		f.	
g.		g.	
h.		h.	
i.		i.	
j.		j.	
k.		k.	
l.		l.	

TEST ANSWERS

BLOCK OR DIVISION NUMBER: 11.0 TITLE: Electrical System (Charging Sub-system)

1. a. Slip ring end frame
   b. Rotor assembly
   c. Stator assembly
   d. Drive end frame
   e. Diodes
   f. Brush assembly
   g. Pulley

2. a. Produces higher output at lower and idle engine speeds.
   b. Simplicity in construction which requires less maintenance

3. Performance skills will be evaluated by the instructor based upon established performance standards for job qualification.

NOTE: Established performance standards include manufacturer's specifications and flat rate plus 20%.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-003)
(DPI - High Schools - N/A)

COURSE: Automotive Servicing (Block 12.0)

COURSE DESCRIPTION: Department of Public Instruction - Currently a limited part of T & I No. 7403-Automotive Engine Tune-Up III and T & I No. 7393 - Auto Mechanics III
Department of Community Colleges - AUT 1100 - Automotive Servicing

INSTRUCTIONAL CONTACT HOURS: High Schools: (Not taught as a separate course)
CC/TI: 99

INSTRUCTIONAL OBJECTIVES:

To provide the learner with the opportunity to apply previous instruction to a full range of experiences of inspecting, testing, adjusting, repairing, and replacing components in the process of "Trouble Shooting" automotive systems, in a simulation of actual automotive shop situations.

QUALIFICATION OR JOB SKILLS GAINED:

This block of instruction does not by itself provide a recognized job level qualification in the Automotive Maintenance Industry. It is designed to provide additional experience in "Trouble Shooting" of automotive systems. This includes the full range of inspecting, testing, adjusting, repairing, removal and replacement of major assemblies, sub-assemblies and components of the automobile, under the direct supervision of the instructor.

PREREQUISITES:

High Schools: Not taught.
Comm. Coll./Tech Inst.: One Year Program - Satisfactory completion of all blocks of instruction in program (0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 7.0 and 8.0).

Two Year Program - Satisfactory completion of all blocks of instruction in program (0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0, 8.0, 9.0, 10.0, 11.0, and 13.0).

PERFORMANCE EVALUATION:

The learner will be required to demonstrate satisfactory performance for the tasks undertaken, 78%. Test items where used will be variations of the standardized test items developed for each block of instruction, with the specific test item being appropriate for the instructional project.

EQUIPMENT REQUIREMENTS:

Equipment appropriate for the assigned project.

ARTICULATION RESEARCH PROJECT

Instructional Guide

PROGRAM: Automotive Mechanics (DCC V-003)
(DPI - High Schools - N/A)

COURSE: Automotive Mechanic Cooperative Training (Block 13.0)

COURSE DESCRIPTION: Department of Public Instruction - (Not identified as used in the context of this program.)

Department of Community Colleges - (No course number)

INSTRUCTIONAL CONTACT HOURS: High Schools: Not taught
CC/TI: 429 hours (Optional)

INSTRUCTIONAL OBJECTIVES:

To provide the learner with the opportunity to apply the skills and related technical information gained from instruction received and to gain further practical experience in inspecting, testing, repairing, adjusting, and replacing automotive components while working in a commercial automotive repair shop, under the supervision of a qualified automotive repair supervisor.

QUALIFICATION OR JOB SKILLS GAINED:

This block of instruction does not by itself provide a recognized job level qualification in the Automotive Maintenance Industry. Its purpose is to provide actual practical work experience in a commercial automotive maintenance shop and to further increase the ability of the learner to meet the minimum performance standards of the industry in the performance of automotive mechanic tasks. This involves inspection, testing, adjusting, repairing, removal and replacement of assemblies and components of the automobile, under the supervision of an experienced mechanic or shop supervisor.

PREREQUISITES:

High Schools: Not Taught.
Comm. Coll./Tech Inst.: One Year Program (Not included in the One Year Program)
Two Year Program - Satisfactory completion of Blocks 0.0, 1.0, 2.0, 3.0, 4.0, 5.0, 7.0, 8.0 and Engine Electrical System Block 11.0, as taught in One Year Automotive Program.

PERFORMANCE EVALUATION:

The learner will be evaluated by his shop supervisor as to his ability to successfully meet minimum industry performance standards as well as to demonstrate his ability to cooperate, follow instructions, and conform to normal shop practices and requirements.

EQUIPMENT REQUIREMENTS:

None (Provided by the shop involved).

ARTICULATION RESEARCH PROJECT
INSTRUCTIONAL GUIDE

PROGRAM: Automotive Mechanics (DCC V-03) (DPI - N/A)

COURSE: Emissions Controls (Block 14.0)

COURSE DESCRIPTION: Department of Community Colleges - Emissions Controls - PME 1133
Department of Public Instruction - N/A

INSTRUCTIONAL CONTACT HOURS: High School - N/A
CC/TI - 55 hours.

INSTRUCTIONAL OBJECTIVES:

1. To provide the student with the information and instruction required to have the competency to service, repair or replace common automotive emissions control systems.

2. To provide the student with information regarding the air pollution problem.

3. To provide the student with information required to know the factors involved in and contributing to automotive emissions.

4. To provide the student with the information required to know types and operation of common emissions control systems and U. S. auto makers using these systems.

JOB QUALIFICATION OR SKILLS GAINED:

Successful completion of this block of instruction provides the student with the instruction required to have the competencies which when coupled with three or more months of on the job experience will qualify the individual to service, repair or replace emissions control systems on U. S. automobiles.

PREREQUISITES:

Block 0.0 (Introduction to Automotive Technology), Block 5.0 (Fuel System Maintenance and Repair), Block 8.0 (Engine Maintenance, Repair and Overhaul), Block 11.0 (Electrical Systems Maintenance and Repair).

PERFORMANCE EVALUATION:

By competency based evaluation to determine student ability to meet job qualification performance standards for tasks peculiar to Emissions Control service, repair or replacement. See test items for this block of instruction.

EQUIPMENT:

Special equipment and tool list for this block attached.

ARTICULATION RESEARCH PROJECT

AUTOMOTIVE TECHNOLOGY

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control

TASK NUMBER: 14.01 TITLE: Know Air Pollution Problem.

INSTRUCTIONAL OBJECTIVE - 14.01: To Learn the Air Pollution Problem.

SKILLS: (Process Objective)

None

RELATED TECHNICAL INFORMATION:

- Definition of air pollution.
- Causes of air pollution.
- Pollution control methods.
- Legal aspects regarding air pollution.
- Environmental impact of air pollution.

SUGGESTED INSTRUCTIONAL TIME: 14.01, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student can define air pollution correctly.
- Student can state three primary sources of air pollution.
- Student can state briefly the primary impact of air pollution control legislation on the automotive service industry.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.02 TITLE: Know Factors Involved In and Contributing To Automotive Emissions.

INSTRUCTIONAL OBJECTIVE - 14.02: To Learn Factors Involved In and Contributing To Automotive Emissions.

SKILLS: (Process Objectives)

14.021 - Know effect of fuel on emissions.
14.022 - Know effect of compression on emissions.
14.023 - Know effect of ignition on emissions.

RELATED TECHNICAL INFORMATION:

- The combustion action of internal combustion engines.
- Exhaust emissions chemical composition.
- Composition and additives of automotive fuels.
- Effect of engine heat upon emissions.
- Undesirable compounds in automotive engine emissions that enter atmosphere and their cause.

SUGGESTED INSTRUCTIONAL TIME: 14.02, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student can state undesirable compounds in automotive engine emissions that enter the atmosphere and their cause.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.03 TITLE: Know Types and Method of Operation of Common Emission Control System and How to Identify Each.

INSTRUCTIONAL OBJECTIVE - 14.03: To Learn Types and Method of Operation of Common Emission Control Systems and How to Identify Each.

SKILLS: (Process Objectives)

14.031 - How to identify and locate type of emission control system on the vehicle.

RELATED TECHNICAL INFORMATION:

- Types of common emission control systems.
- Method of operation of common emission control systems.
- Manufacturer's manuals.
- Major U. S. automobile makers with different types of emissions control systems used by each.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.03, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student can identify five of six emission control systems accurately by inspection.
- Student can state accurately the method of operation of five of six different emission control systems.
- Student can state types of emissions controls used by each major U. S. automobile maker.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.035 TITLE: Test, Service, Remove and Replace Catalytic Converters.

INSTRUCTIONAL OBJECTIVE - 14.035: How to Test, Service, Remove and Replace Catalytic Converters.

SKILLS: (Process Objectives)

How to:

14.0351 - Use special tools and test equipment.
14.0352 - Test catalytic converters for proper operation.
14.0353 - Service catalytic converters.
14.0354 - Remove catalytic converters.
14.0355 - Replace catalytic converters.

RELATED TECHNICAL INFORMATION:

- Purpose and operation of catalytic converters.
- Types of catalytic converters used by automobile manufacturers.
- Service manuals.
- Test equipment manuals.
- Special tool requirements.
- Effect of catalytic converters on engine operations.
- Special fuel requirements.
- Manufacturer's specifications.

SUGGESTED INSTRUCTIONAL TIME: 14.035, 6 hours.

REQUIRED PERFORMANCE STANDARDS:

- Can accurately state purpose and operation of catalytic converters.
- Can perform tests according to service manual.
- Can perform service, removal and replacement of catalytic converters according to manufacturer's specifications in Flat Rate plus 20% time limitations.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.04 TITLE: Service, Repair or Replace Positive Crankcase Ventilation Systems.

INSTRUCTIONAL OBJECTIVE - 14.04: How to Service, Repair or Replace Positive Crankcase Ventilation Systems.

SKILLS: (Process Objectives)

14.041 - How to inspect and clean the PCV emissions control system.
14.042 - How to test the PCV emissions control system.
14.043 - How to repair the PCV emissions control system.
14.044 - How to remove and replace the PCV emissions control system.
14.045 - How to use a smog analyzer.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Method of operation of PCV emissions control system.
- Smog analyzer instructions manual.
- Auto manufacturer's using PCV control systems.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.04, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student performs task according to the manufacturer's specifications.
- Student uses smog analyzer correctly.
- Student performs task in flat rate plus 20% time or less.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (Continued)

TASK NUMBER: 14.05 TITLE: Service, Repair or Replace Fuel Evaporation Systems.

INSTRUCTIONAL OBJECTIVE - 14.05: How to Service, Repair or Replace Fuel Evaporation Systems.

SKILLS: (Process Objective)

14.051 - How to inspect and clean fuel evaporation systems.
14.052 - How to test fuel evaporation systems.
14.053 - How to repair fuel evaporation systems.
14.054 - How to remove and replace fuel evaporation systems.
14.055 - How to use a smog analyzer.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Method of operation of fuel evaporation systems.
- Smog analyzer instructions manual.
- Auto manufacturer's using fuel evaporation systems.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.05, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student performs task according to manufacturer's specifications.
- Student uses smog analyzer correctly according to manual.
- Student performs task in Flat Rate plus 20% elapsed time.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.06 TITLE: Service, Repair or Replace Air Injection Systems.

SKILLS: (Process Objectives)

14.061 - How to inspect and clean the air injection system.
14.062 - How to test the air injection system.
14.063 - How to repair the air injection system.
14.064 - How to remove and replace the air injection system.
14.065 - How to use the smog analyzer.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Method of air injection system operation.
- Smog analyzer instructions manual.
- Auto manufacturer's using air injection systems.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.06, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student performs task according to the manufacturer's specifications.
- Student uses smog analyzer correctly.
- Student performs task in Flat Rate plus 20% time or less.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.07 TITLE: Service, Repair, or Replace Thermostatic Air Cleaners.

INSTRUCTIONAL OBJECTIVE - 14.07: How to Service, Repair or Replace Thermostatic Air Cleaners.

SKILLS: (Process Objectives)

14.071 - How to inspect and clean thermostatic air cleaners.
14.072 - How to test thermostatic air cleaners.
14.073 - How to repair thermostatic air cleaners.
14.074 - How to remove and replace thermostatic air cleaners.
14.075 - How to use a smog analyzer.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Method of operation of thermostatic air cleaners.
- Smog analyzer instructions manual.
- Auto manufacturer's using thermostatic air cleaners.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.07, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student performs task according to the manufacturer's specifications.
- Student uses smog analyzer correctly.
- Student performs task in Flat Rate plus 20% time or less.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.08 TITLE: Service, Repair or Replace Exhaust Air Recirculation Systems.

INSTRUCTIONAL OBJECTIVE - 14.08: How to Service, Repair or Replace Exhaust Air Recirculation Systems.

SKILLS: (Process Objectives)

14.081 - How to inspect and clean exhaust air recirculation systems.
14.082 - How to use a smog analyzer.
14.083 - How to test exhaust air recirculation systems.
14.084 - How to repair exhaust air recirculation systems.
14.085 - How to remove and replace exhaust air recirculation systems.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Method of operation of exhaust air recirculation systems.
- Smog analyzer instructions manual.
- Auto manufacturer's using exhaust air recirculation systems.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.08, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student performs task according to the manufacturer's specifications.
- Student uses smog analyzer correctly.
- Student performs task in Flat Rate plus 20% time or less.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.09 TITLE: Service, Repair or Replace Engine Modification Systems.

INSTRUCTIONAL OBJECTIVE - 14.09: How to Service, Repair or Replace Engine Modification Systems.

SKILLS: (Process Objectives)

14.091 - How to inspect and clean engine modification systems.
14.092 - How to use a smog analyzer.
14.093 - How to test engine modification systems.
14.094 - How to repair engine modification systems.
14.095 - How to remove and replace engine modification systems.

RELATED TECHNICAL INFORMATION:

- Manufacturer's specifications.
- Method of operation of engine modification systems.
- Smog analyzer instructions manual.
- Auto manufacturer's using engine modification systems.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.09, 5 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student performs task according to the manufacturer's specifications.
- Student uses smog analyzer correctly.
- Student performs task in Flat Rate plus 20% time or less.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.10 TITLE: Know Impact of Emissions Control Systems on Engine Operations.

INSTRUCTIONAL OBJECTIVE - 14.10: Learn Impact of Emissions Control Systems On Engine Operations.

SKILLS: (Process Objectives)

14.101 - How to identify engine operation problems caused by faulty emissions controls.

RELATED TECHNICAL INFORMATION:

- Principles of emissions control.
- Principles of internal combustion engines.
- Impact of emissions control systems on automotive engine operations.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.10, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student can state accurately the impact of emissions control systems on automotive engine operations.
- Student can identify engine operations problems that can be caused by the emissions control system.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.11 TITLE: Know Impact of Engine Operations on Emissions Control Systems.

INSTRUCTIONAL OBJECTIVE - 14.11: To Learn the Impact of Engine Operations On Emissions Control Systems.

SKILLS: (Process Objectives)

None

RELATED TECHNICAL INFORMATION:

- Principles of operations of emissions controls.
- Principles of operations of internal combustion engines.
- Relationship of engine operations to emissions controls.
- Effect of engine operations on the operation of emission control systems.
- Operation and effect of catalytic converter.

SUGGESTED INSTRUCTIONAL TIME: 14.11, 2 hours.

REQUIRED PERFORMANCE STANDARDS:

- Student can state accurately the effect of engine operations upon the operation of the emissions control system.

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control (continued)

TASK NUMBER: 14.12 TITLE: Remove and Replace Tailpipe and/or Muffler.

INSTRUCTIONAL OBJECTIVE - 14.12: How to Remove and Replace Tailpipe and/or Muffler.

SKILLS: (Process Objectives)

How to:

14.121 - Inspect tailpipes and mufflers.
14.122 - Remove and replace tailpipes.
14.123 - Remove and replace mufflers.

RELATED TECHNICAL INFORMATION:

- Service manuals.
- Manufacturer's specifications.
- Proper tools and equipment.
- Hazards caused by leaking mufflers and tailpipes.

SUGGESTED INSTRUCTIONAL TIME: 14.12, 4 hours.

REQUIRED PERFORMANCE STANDARDS:

- Conducts inspection according to service manual.
- Removes and replaces tailpipe and/or muffler according to manufacturer's specifications using proper tools and equipment correctly.
- No leaks or rattles when tested.
- Performs task in Flat Rate plus 20% time limits.

TEST ITEM OUTLINES

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control

14.01 a. Define Air Pollution.
Standard: Student can give official or textbook definition of air pollution.

b. State three primary sources of air pollution and its effect on people.
Standard: Student can state accurately three major sources of air pollution and their effect on people.

c. State briefly the impact of governmental air pollution control legislation upon the automobile.
Standard: At a minimum, the student identifies emissions control systems upon automobiles and need to use lead-free gasoline as some major results of impact of air pollution control legislation upon the automobile.

14.02 Identify the primary undesirable compounds that result from automotive gasoline engine emissions that enter the atmosphere and their cause.
Standard: Student identifies correctly three primary air pollutants resulting from automotive engine operations and states the cause.

14.03 Given three different makes of U. S. emissions control devices, the student will:
a. Locate the devices by inspection.
b. Identify the type of device.
c. State how each system functions to control harmful emissions.
Standard: There are 9 parts to this test item. The student should get the first three (a) correct and at least two each correct of the remaining items in (b) and (c).

14.04 Given an automobile with a PCV emissions control system and a smog analyzer, plus necessary tools:
a. Student will inspect and clean PCV system.
b. Student will test the PCV system using smog analyzer.
Standard: Student performs tasks according to manufacturer's specifications and uses smog analyzer as required by manufacturer's instructions, within Flat Rate plus 20% time limits. Uses correct tools where required.

14.04 Written or Oral: Student will state the principle of operation of the PCV emissions control system.

14.05 Given an automobile with a faulty fuel evaporation emissions control system and necessary tools: Student will determine problem and repair or remove and replace the system.
Standard: Student inspects system making necessary tests. Determines problem correctly and takes necessary action according to manufacturer's specifications; uses test equipment and tools correctly. Performs task within Flat Rate plus 20% time limits. Tests vehicle after performing necessary service.

TEST ITEMS (Cont'd.)

14.05 Written: Student will state the operating principle of the fuel evaporation emissions control system.

14.06 Given an automobile with an Air Injection Emissions Control System and information that system is adversely effecting engine operations, student will test system to determine the problem, select proper tools and take necessary remedial action.
Standard: Student inspects system, selects and uses proper test equipment according to manufacturer's instructions, selects proper tools and uses them correctly, according to manufacturer's specifications. Performs task in Flat Rate plus 20% time.

14.06 Written: Student will state the operating principle of the air injection emissions control system.

14.07 Given: Automobile with thermostatic air cleaner that is fully operational and necessary tools and equipment the student will be required to identify, inspect, clean, test and report the condition of the emissions control system.
Standard: Student identifies the emissions system correctly, follows procedures according to manufacturer's specifications and test equipment manuals, and reports correctly the condition of the emission control system.

14.07 Written: Student will state the operating principle of the thermostatic air cleaner.

14.08 Given: An automobile with a faulty exhaust air recirculation emissions control system the student will identify, inspect, test, remove and replace the emissions control system.
Standard: Student identifies system correctly, makes test according to manufacturer's manual and reaches correct test results, uses correct tools properly to remove and replace the faulty system, according to manufacturer's specifications. Task completed with Flat Rate plus 20% time limits.

14.08 Written: Student will state the operating principle of exhaust air recirculation emissions control system.

14.09 Given: An automobile with an engine modification emissions control system that is dirty, a smog analyzer, and necessary tools the student will identify the system, inspect, test and clean the system and report the problem.
Standard: Student identifies system correctly, conducts inspection and tests according to manufacturer's specifications and equipment manual. Cleans system correctly and reports the problem. Performs the task in Flat Rate plus 20% time limits.

14.09 Written: Student will state the operating principle of the engine modifications emissions control system.

TEST ITEMS (Cont'd.)

14.10 Given: Three different automobiles with different emissions control systems; engines do not operate because of faulty control systems. Student will be required to determine cause of improper engine operations. Standard: Student correctly determines that the engine operation problems were caused by the faulty emissions control systems. Uses test equipment according to manufacturer's instructions manual. Using Flat Rate Manual instructor determines time limits.

14.10 Written: State the impact of improperly operating emissions control systems upon engine operations.

14.11 Student will state the effect of engine operations upon the operations of the emissions control system.

Standards for written test items 14.0-14.12: Student answer is in accordance with the explanations in the manufacturer's service manuals for the item in question.

Performance standards for evaluation of initial entry job qualification, all test items, this block of instruction: Student should be capable of meeting the performance standards of 80% of the performance type test items and 80% of the written or oral type test items.

14.12 Given an automobile with leaking muffler the student will inspect exhaust system, detect problem, select proper tools and equipment and prepare requisition for correct muffler. Show instructor the procedure to be followed to remove and replace muffler.
Standard: Student states the correct service manual and manufacturer's procedures for muffler inspection and replacement.

14.035 Given an automobile engine with an operational catalytic converter:

a. Student will perform an operations test of the catalytic converter.

b. Student will select proper tools and state how he would service the converter if such action was required.

Standards:
a. Student uses proper test equipment and diagnoses catalytic converter correctly according to equipment and service manuals.
b. Student selects proper tools and states service actions according to service manual.

14.035 Written or Oral - State purpose and operation of catalytic converters.
Standard: Student states the key elements required as contained in the textbook and service manuals.

AUTOMOTIVE TECHNOLOGY

SPECIAL TOOLS AND EQUIPMENT

BLOCK OR DIVISION NUMBER: 14.0 TITLE: Emissions Control

Infrared Exhaust Emissions (Smog) Tester
Catalytic Converter Aspirator*
Catalytic Converter Vibrator*
CT-3 PCV Tester*

*Especially required in servicing General Motors automobiles equipped with a catalytic converter and PCV emissions control system.

ARTICULATION RESEARCH PROJECT

AUTOMOTIVE MECHANICS

MASTER TOOL & EQUIPMENT LIST
(For Class Size - 15 Students)

DESCRIPTION	NUMBER EACH
Wrenches:	
Combination 5/16, 3/8, 7/16, 1/2, 9/16 [sets] (box & open end)	5 sets
Combination 11/16 through 1 1/4 (box & open end)	5 sets
Ignition sets	3 sets
Adjustable 4-6-8-10 inch (Crescent) 12 inch	1 each
Pipe 8-12-16 inch	1 each
Valve adjusting	1 set
Flare nut	1 set
Distributor	1 each
Drain plug	1 each
Torque 3/8" drive 0-150 in. lbs. 1/2" drive 10-150 ft. lbs.	2 each
Brake adjusting tool (assorted types)	3 each
Brake bleeding wrench (assorted types)	3 each
Hand impact driver	1 each
Socket Sets:	
1/4 inch drive	3 sets
3/8 inch drive Flexsocket & deep hex sockets	3 sets
1/2 inch drive " " " "	3 sets
Spark plug socket 5/8" & 13/16" Flexsocket	3 each
Oil pressure and temperature sending unit socket	1 each
Gages:	
Spark plug (wire)	3 each
Feeler gage (flat) 1 to 40 thousandths	3 each

MASTER TOOL AND EQUIPMENT LIST (cont'd.)

DESCRIPTION	NUMBER EACH
Pliers:	
Needle-nose 6"	3 each
Diagonal Cutting 6"	3 each
Vise grips 10"	3 each
Channel Lock 12"	3 each
General purpose 8"	3 each
Hose clamp 7 3/4"	3 each
Battery pliers	1 each
Snap ring (internal) set	1 each
Snap ring (external) set	1 each
Wire crimper	1 each
Spark plug terminal plier	1 each
Screwdrivers:	
Regular - set of 6	3 sets
Phillips Head - set of 6	3 sets
Clutch Head (figure 8) set of 4	1 set
Offset Regular & Phillips	1 set each
Hammers:	
Ball pein (small) 4 oz.	3 each
Ball pein (medium) 8 oz.	3 each
Ball pein (large) 16 oz.	3 each
Sledge 2 1/2 lb.	3 each
Soft face (plastic) 1/2 and 1 lb.	3 each
Rubber mallet	3 each
Chisels:	
Regular-assorted sizes	3 sets

MASTER TOOL AND EQUIPMENT LIST (cont'd.)

DESCRIPTION	NUMBER EACH
Punches:	
Center-assorted sizes	3 sets
Pin-assorted sizes	3 sets
Hand hack saws	3 each
Files-assorted sizes and shapes	3 sets
C-clamps 3 to 6 inch	2 each
Steel rule (tape) 6 foot	3 each
Steel rule (flat) 12 inch	3 each
Straight edge ✓	1 each
Calipers (inside) 3", 4", 6", 8"	1 each
Calipers (outside) 3", 4", 6", 8"	1 each
Micrometers:	
0-1 inch	1 each
1-2 inch	1 each
2-3 inch	1 each
3-4 inch	1 each
4-5 inch	1 each
5-6 inch	1 each
Inside dial indicator	1 each
Floor jack 4 ton	2 each
Hydraulic jack (upright) large [10 ton] - small [5 ton]	1 each
Car stands	12 each
Chain hoist and trolley	1 each
Air compressor - 5 horsepower	1 each
Oxy. acetylene welding and cutting outfit	1 each
Electric arc welder	1 each
Valve shop	1 each

MASTER TOOL AND EQUIPMENT LIST (cont'd.)

DESCRIPTION	NUMBER EACH
Engine stands	5 each
Armature growler	1 each
Bench grinder and buffer combination	1 each
Electric drill 1/4 and 1/2 inch cap.	1 each
Drill press (bench or floor model)	1 each
Drill bits - high speed	2 sets
Work benches (metal)	5 each
Drain pans (water)	3 each
Drain pans (oil)	3 each
Gasoline can	1 each
Radiator filler	1 each
Battery filler	1 each
Battery hydrometer	1 each
Anti-freeze hydrometer	1 each
Floor creepers	5 each
Ign. timing light	3 each
Extension cords (lights)	5 each
Oilers (plews pistol grip)	3 each
Oil pouring spout	3 each
Brake fluid dispenser	1 each
Transmission grease dispenser	1 each
Transmission fluid funnel (flexible)	2 each
Soldering gun (pistol grip) 100W & 500W	2 each
Electric soldering iron (large)	1 each
Ring ridge reamer	2 each
Ring groove cleaner (piston)	3 each

MASTER TOOL AND EQUIPMENT LIST (cont'd.)

DESCRIPTION	NUMBER EACH
Ring compressor (piston)	3 each
Compression testers	1 each
Vacuum and fuel pump testers	1 each
Brake cyl. hone	2 each
Engine cyl. hone	1 each
Vises, 4 inch	2 each
Vises, 6 inch	1 each
Gear and wheel pullers - Master Puller Set SD6	1 set
Tune-up or engine analyzer	1 each
Fender cover	5 pair
Brake drum and rotor lathe with radius grinding attachment	1 each
Propane carburetor kit	1 each
Hydraulic press	1 each
Universal dial indicator	1 each
Headlight dimming kit	1 each
For Emissions Control	
Infra-red exhaust emissions tester	1 each
Catalytic converter aspirator	1 each
Catalytic converter vibrator	1 each
CT-3 PCV Tester	1 each

ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Introduction to Automotive Mechanics, Block 0.0
Shop Operations and Safety, Sub-Block 0.10

(For Instructor's File)

NAME: ______________________ DATE: ______________

CERTIFIED BY: ______________________ TITLE: ______________

INSTITUTION: ______________________

CODE	TASKS
[U L M S]	Knows and practices shop safety. (Fire, cleanliness, orderly work area, lifting, exhaust fumes, acid, etc.)
[U L M S]	Knows first-aid requirements for normal shop hazards. (Burns, electrical shock, injury, poison, carbon monoxide, fumes, etc.)
[U L M S]	Identifies, learns how to use properly, and maintains common hand tools.

CODE	TASKS
[U L M S]	Identifies, learns how to use properly, and maintains items of common shop equipment. (Jacks, lifts, air compressors, etc.)
[U L M S]	Identifies, learns how to use properly, and maintains items of common use shop machinery. (Grinders, drills, etc.)
[U L M S]	Know performance requirements of Standard Shop Operating Procedures. (Flat rate manual, job orders, parts requisitions, common shop terminology [jargon].

GENERAL ATTITUDE:

[U L M S] Industrious and energetic

[U L M S] Cooperative with associates and instructors.

[U L M S] Dependable

[U L M S] Punctual

CODE - Circle appropriate letter.

U - Unqualified.
L - Limited skill, requires supervision.
M - Moderate skill, requires minimum supervision.
S - Skilled, works independently.

ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Introduction to Automotive Mechanics, Block 0.0

The Motor Vehicle: Assembly Identification, Assembly and Vehicle Mechanical Operation, and Driver Maintenance, Sub-Block 0.20
(For Instructor's File)

NAME: ______________________ DATE: ______________

CERTIFIED BY: __________________ TITLE: ______________

INSTITUTION: __________________

CODE	TASKS
[U L M S]	Lubrication and Tires, Knows types, purpose, application, and care.
[U L M S]	Cooling System: Knows purpose, operation, major parts, and care.
[U L M S]	Automobile Heater: Knows purpose, operation, major parts, and care.
[U L M S]	Braking System: Knows purpose, operation, major parts, and care.
[U L M S]	Fuel System: Knows purpose, types of fuel, system operations, major parts and care.
[U L M S]	Steering System and Front End: Knows purpose, operation, major parts, and care.

CODE	TASKS
[U L M S]	Power Train and Manual Transmission: Knows purpose, operations, major parts, and care.
[U L M S]	Engine: Knows purpose, operations, major parts, and care.
[U L M S]	Automobile Air Conditioners: Knows purpose, operation, major parts, and care.
[U L M S]	Automatic Transmission: Knows purpose, operation, major parts, and care.
[U L M S]	Automotive Electrical System: Purpose, operations, major parts, and care.

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Introduction to Automotive Mechanics, Block 0.0

The Automotive Technician, Sub-Block 0.30

(For Instructor's File)

NAME: ______________________________ DATE: ________________

CERTIFIED BY: ________________________ TITLE: ________________

INSTITUTION: ________________________

CODE	TASKS	CODE	TASKS
[U L M S]	Knows opportunities and job availability for the automotive technician.	[U L M S]	Knows how to meet people and to be accepted by fellow employees.
[U L M S]	Knows how to get a job, hold a job, and earn advancement. (Good references, first impressions, reliability, quality performance, etc.)	[U L M S]	Knows the technician's responsibilities toward his employer, the customer, and his craft. [The work ethic, honesty, legal concerns, public relations, the shop image, etc.)

GENERAL ATTITUDE:

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Lubrication and Vehicle Operating Maintenance, Block 1.0

(For Instructor's File)

NAME: ______________________________ DATE: ____________________

CERTIFIED BY: ______________________ TITLE: ____________________

INSTITUTION: _______________________

CODE TASKS

[U L M S] Change oil and filters.

[U L M S] Lubricate vehicles and equipment.

[U L M S] Remove, repair or replace tires, maintain equipment.

CODE TASKS

[U L M S] Perform road service, recovery and towing.

[U L M S] Winterize vehicles.

COURSE: Cooling System Maintenance and Repair, Block 2.0

[U L M S] Check coolant freezing point.

[U L M S] Inspect and replace water hoses.

[U L M S] Pressurize and inspect coolant system.

[U L M S] Test and replace thermostat.

[U L M S] Check overflow tank & accessories.

[U L M S] Remove and reinstall radiators.

[U L M S] Chemically clean and flush cooling system.

[U L M S] Replace water pump.

[U L M S] Replace freeze plugs.

GENERAL ATTITUDE:

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Automobile Heater Maintenance and Repair, Block 3.0
(For Instructor's File)

NAME: ______________________________ DATE: ________________

CERTIFIED BY: _______________________ TITLE: ________________

INSTITUTION: ________________________

CODE	TASKS
[U L M S]	Inspect and replace defroster hose.
[U L M S]	Service heater control components.
[U L M S]	Replace water heater control core.
[U L M S]	Service or replace circulating heater.
[U L M S]	Diagnose heating system malfunctions.

COURSE: Braking System Maintenance and Repair, Block 4.0

[U L M S] Adjust brakes.
[U L M S] Adjust hand brake linkage.
[U L M S] Free up parking brake cables.
[U L M S] Replace hand brake linkage.
[U L M S] Bleed brakes.
[U L M S] Inspect, repair or replace self adjusters.
[U L M S] Replace brake hoses and lines.
[U L M S] Inspect and replace brake pads (disc brakes).
[U L M S] Inspect and replace brake shoes.
[U L M S] Inspect and turn rotor if necessary (disc brakes).
[U L M S] Inspect and turn brake drum.
[U L M S] Repair or replace wheel cylinder.
[U L M S] Repair or replace master cylinder.
[U L M S] Repair or replace hydraulic power cylinders and valves.
[U L M S] Perform operational brake inspections.

GENERAL ATTITUDE:

[U L M S] Industrious and energetic
[U L M S] Cooperative with associates and instructors
[U L M S] Dependable
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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Fuel System Maintenance and Repair, Block 5.0
(For Instructor's File)

NAME: ______________________________ DATE: __________________

CERTIFIED BY: ______________________ TITLE: __________________

INSTITUTION: _______________________

CODE	TASKS
[U L M S]	Inspects, services, or replaces carburetor air cleaner.
[U L M S]	Cleans or replaces fuel filter units.
[U L M S]	Removes, services, or replaces fuel pumps or fuel lines and hoses.
[U L M S]	Installs carburetors.
[U L M S]	Inspects and measures fuel flow and pressure of system.
[U L M S]	Adjusts carburetor.
[U L M S]	Inspects, cleans and adjusts choke unit (automatic and manual).
[U L M S]	Inspects, services, or replaces gas tank, cap and sending unit.
[U L M S]	Repairs or services carburetors.
[U L M S]	Repairs or services exhaust emission control systems, to include manifold heat.
[U L M S]	Analyzes fuel injection problems by means of electrical diagnostic equipment.
[U L M S]	Performs operational inspections of exhaust emission control system.

GENERAL ATTITUDE:

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[U L M S] Cooperative with associates and instructors

[U L M S] Dependable

[U L M S] Punctual

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Steering and Front End Maintenance and Repair, Block 6.0

(For Instructor's File)

NAME: ______________________ DATE: ______________

CERTIFIED BY: ______________________ TITLE: ______________

INSTITUTION: ______________________

CODE	TASKS
[U L M S]	Lubricates the front and rear suspension.
[U L M S]	Replaces belts and sets tension.
[U L M S]	Adjusts worm and sector in steering box, inspects steering.
[U L M S]	Repairs or replaces manual steering components.
[U L M S]	Repairs, rebuilds, or replaces power steering components.
[U L M S]	Repairs or replaces tilt and telescoping and collapsible mast jackets.
[U L M S]	Performs visual inspections of suspension systems.
[U L M S]	Replaces shock absorbers & mounting.
[U L M S]	Replaces front wheel bearings grease seal.
[U L M S]	Repairs or replaces rear suspension systems.
[U L M S]	Inspects and repairs front suspension systems.
[U L M S]	Replaces pivot points on steering linkage.
[U L M S]	Rebushes king pins or link pins.
[U L M S]	Replaces ball joints.
[U L M S]	Replaces front suspension control arms and bushings.
[U L M S]	Adjusts or replaces torsion and trunion bars.
[U L M S]	Balances wheels and tires.
[U L M S]	Inspects, adjusts and repacks front wheel bearing.
[U L M S]	Inspects and replaces steering spindles.
[U L M S]	Inspects and aligns front end.
[U L M S]	Inspects and aligns rear end.

GENERAL ATTITUDE:

[U L M S] Industrious and energetic

[U L M S] Cooperative with associates and instructors

[U L M S] Dependable

[U L M S] Punctual

CODE - Circle appropriate letter.

U - Unqualified.
L - Limited skill, requires supervision.
M - Moderate skill, requires minimum supervision.
S - Skilled, works independently.

ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Power Train and Manual Transmission Maintenance & Repair, Block 7.0
(For Instructor's File)

NAME: ______________________________ DATE: ________________

CERTIFIED BY: __________________________ TITLE: ________________

INSTITUTION: ______________________________

CODE	TASKS
[U L M S]	Lubricates U-joints.
[U L M S]	Lubricates speedometer cable drive gear and housing.
[U L M S]	Repairs or replaces slip-joints or U-joints.
[U L M S]	Replaces drive-line seals.
[U L M S]	Tests and replaces out-of-round drive shaft.
[U L M S]	Inspects drive shafts, U-joints and center bearing.
[U L M S]	Replaces manual transmission gaskets and seals (in-car repairs).
[U L M S]	Replaces pilot bearings.
[U L M S]	Replaces throwout bearings.
[U L M S]	Adjusts mechanical-type clutch.
[U L M S]	Adjusts external shift linkage on manual transmissions.

CODE	TASKS
[U L M S]	Inspects shifting.
[U L M S]	Performs operational manual transmission inspections.
[U L M S]	Replaces mechanical-type clutch.
[U L M S]	Replaces a manual transmission.
[U L M S]	Rebuilds manual transmission (major repairs).
[U L M S]	Rebuilds overdrive unit.
[U L M S]	Replaces rear-axle shaft, bearings and seal.
[U L M S]	Replaces pinion seal.
[U L M S]	Replaces differentials.
[U L M S]	Overhauls differentials.
[U L M S]	Perform operational inspections of differentials.
[U L M S]	Road tests inspections of differentials.

GENERAL ATTITUDE:

[U L M S] Industrious and energetic.

[U L M S] Cooperative with associates and instructors.

[U L M S] Dependable.

[U L M S] Punctual.

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Engine - Maintenance, Repair, and Overhaul, Block 8.0

(For Instructor's File)

NAME: ______________________________ DATE: __________________

CERTIFIED BY: ________________________ TITLE: __________________

INSTITUTION: _________________________

CODE	TASKS
[U L M S]	Cleans engines.
[U L M S]	Removes and replaces tail pipe assemblies.
[U L M S]	Removes and replaces muffler.
[U L M S]	Inspects exhaust systems.
[U L M S]	Inspects or removes and replaces exhaust manifolds.
[U L M S]	Removes and replaces engine mounts.
[U L M S]	Performs operational inspections of positive crankcase ventilation systems.
[U L M S]	Repairs or services crankcase ventilation systems.
[U L M S]	Runs compression test.
[U L M S]	Performs cylinder leakage test.
[U L M S]	Performs cylinder balance test.
[U L M S]	Diagnoses valve train and head malfunctions.
[U L M S]	Cleans engine parts and makes visual check for condition.
[U L M S]	Removes and replaces pan and valve covers.
[U L M S]	Performs operational inspections of engine lubrication systems.
[U L M S]	Removes and replaces gaskets and seals.

CODE	TASKS
[U L M S]	Removes and replaces head gaskets.
[U L M S]	Inspects head for warp.
[U L M S]	Adjusts valves.
[U L M S]	Removes and replaces valves.
[U L M S]	Grinds valves.
[U L M S]	Resurfaces valve seats.
[U L M S]	Removes and replaces valve lifters.
[U L M S]	Removes and replaces valve guides.
[U L M S]	Removes and replaces valve seats.
[U L M S]	Machines valve guides for special seals.
[U L M S]	Removes and replaces oil pumps.
[U L M S]	Repairs oil pumps.
[U L M S]	Removes and replaces timing gears and chains.
[U L M S]	Removes and replaces flywheel.
[U L M S]	Removes and replaces flywheel ring gears.
[U L M S]	Removes and replaces engines from vehicles.

Student Vocational Skills Record

COURSE: Engine - Maintenance, Repair, and Overhaul, Block 8.0 (cont'd.)

CODE	TASKS
[U L M S]	Removes and replaces connecting rods and bearings.
[U L M S]	Removes and replaces pistons.
[U L M S]	Removes and replaces rings on pistons.
[U L M S]	Removes and replaces crankshaft and bearings.
[U L M S]	Inspects crankshaft and connecting rod assembly using micrometers and other equipment.
[U L M S]	Inspects and corrects bearing fit.
[U L M S]	Removes and replaces camshaft.
[U L M S]	Removes and replaces camshaft bearings.

GENERAL ATTITUDE:

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[U L M S] Cooperative with associates and instructors

[U L M S] Dependable

[U L M S] Punctual

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Automobile Air Conditioner Maintenance and Repair, Block 9.0

(For Instructor's File)

NAME: ______________________ DATE: ______________________

CERTIFIED BY: ______________________ TITLE: ______________________

INSTITUTION: ______________________

CODE	TASKS
[U L M S]	Discharges system.
[U L M S]	Removes and replaces air conditioner fan motor.
[U L M S]	Removes and replaces dryer in air conditioning unit.
[U L M S]	Services air conditioner control cables and switches.
[U L M S]	Removes and replaces freon control valve [~~or diaphragm~~] in air conditioning unit.
[U L M S]	Removes and replaces expansion valve in air conditioning unit.
[U L M S]	Removes and replaces compressor seals.

CODE	TASKS
[U L M S]	Removes and replaces condenser in air conditioning unit.
[U L M S]	Removes and replaces evaporator in air conditioning unit.
[U L M S]	Repairs or removes and replaces air conditioning compressor.
[U L M S]	Installs air conditioners in vehicles.
[U L M S]	Pressure tests, performance tests, and leak tests the system.
[U L M S]	Diagnoses air conditioning malfunctions.
[U L M S]	Repairs automatic a/c and heater systems vacuum and electrical circuits.

GENERAL ATTITUDE:

[U L M S] Industrious and energetic

[U L M S] Cooperative with associates and instructors

[U L M S] Dependable

[U L M S] Punctual

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Automatic Transmissions Maintenance and Repair, Block 10.0

(For Instructor's File)

NAME: ______________________ DATE: ______________

CERTIFIED BY: ______________ TITLE: ______________

INSTITUTION: ______________

CODE TASKS

[U L M S] Adjusts floor shift linkage.

[U L M S] Adjusts linkage from steering column to automatic transmission.

[U L M S] Adjusts linkage from engine to automatic transmission.

[U L M S] Cleans and visually inspects transmission.

[U L M S] Diagnoses, replaces, or adjusts modulators.

[U L M S] Services filter and checks transmission cooling system.

[U L M S] Replaces or adjusts neutral switch.

CODE TASKS

[U L M S] Makes external adjustment of bands on automatic transmissions.

[U L M S] Removes and installs automatic transmission.

[U L M S] Removes and replaces external seals, gaskets, and lines on automatic transmissions.

[U L M S] Inspects and removes and replaces converter.

[U L M S] Inspects and repairs front pump and components.

[U L M S] Make internal repairs and adjustments on automatic transmissions.

[U L M S] Performs operational automatic transmission inspections.

GENERAL ATTITUDE:

[U L M S] Industrious and energetic

[U L M S] Cooperative with associates and instructors

[U L M S] Dependable

[U L M S] Punctual

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ARTICULATION RESEARCH PROJECT
JAMES SPRUNT INSTITUTE AND DUPLIN COUNTY PUBLIC HIGH SCHOOLS

Student Vocational Skills Record

COURSE: Automotive Electrical Systems Maintenance and Repair, Block 11.0

(For Instructor's File)

NAME: ______________________________ DATE: ____________________

CERTIFIED BY: ________________________ TITLE: ____________________

INSTITUTION: _________________________

CODE	TASKS
[U L M S]	Cleans, gaps, and tests spark plugs.
[U L M S]	Replaces light bulbs.
[U L M S]	Replaces flasher units.
[U L M S]	Services or replaces batteries, cables, and battery boxes.
[U L M S]	Performs operational inspections of lighting and electrical systems.
[U L M S]	Removes and replaces stop-light switch.
[U L M S]	Adjusts headlights.
[U L M S]	Adjusts, removes, repairs, or replaces back-up light switches.
[U L M S]	Sets ignition timing.
[U L M S]	Removes and replaces generators or alternators.
[U L M S]	Removes and replaces starters.
[U L M S]	Repairs starters and solenoids.
[U L M S]	Repairs generators or alternators.
[U L M S]	Repairs or removes and replaces charging system regulators.
[U L M S]	Analyzes malfunctions in the cranking system.

CODE	TASKS
[U L M S]	Removes, repairs, replaces and adjusts distributor.
[U L M S]	Removes and replaces turn signal switches.
[U L M S]	Removes and repairs windshield wiper mechanisms or controls.
[U L M S]	Removes and replaces fuse block assembly.
[U L M S]	Removes and replaces chassis and under-hood wiring.
[U L M S]	Tests and rewires dash units.
[U L M S]	Tests and repairs automatic alarm systems of safety items.
[U L M S]	Tests and repairs cruise control units.
[U L M S]	Evaluates alternator, generator and regulator output.
[U L M S]	Analyzes or adjusts engine performance using engine analyzer.
[U L M S]	Inspects and tests secondary circuit leads, plug wires, distributor cap, and rotor.
[U L M S]	Inspects and repairs ignition switch, resistor, wiring, coil, points, and condenser of the primary circuit.

Student Vocational Skills Record

COURSE: Automotive Electrical Systems Maintenance and Repair, Block 11.0 (cont'd.)

CODE	TASKS	CODE	TASKS
[U L M S]	Locates and repairs shorts and open circuits in wiring.	[U L M S]	Measures resistance in plug wires.
		[U L M S]	Completes engine tune-up.

GENERAL ATTITUDE:

[U L M S] Industrious and energetic

[U L M S] Cooperative with associates and instructors

[U L M S] Dependable

[U L M S] Punctual

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ARTICULATION RESEARCH PROJECT
ARTICULATION OF OCCUPATIONAL EDUCATION PROGRAMS

STATE PILOT MODEL

AUTOMOTIVE MECHANICS PROGRAM

TEST ITEMS SUPPLEMENT

Prepared by the Duplin Area Automotive Advisory and Program Committee
Automotive Instructional Personnel
September 1976

Lloyd Stevens, Executive Secretary - Assistant Superintendent for Occupational Education, Duplin County Public Schools

Richard Fry, Automotive Instructor - James Sprunt Institute

Donald Grady, Automotive Teacher - East Duplin High School

Marvin Dazey, Automotive Teacher - James Kenan High School

William Lewis, Automotive Teacher - North Duplin High School

Jerry K. Grady, Automotive Teacher - Wallace-Rose Hill High School

Reviewed and updated July 1977 for the State Pilot Model by State Automotive Advisory and Program Committee.

Editor - Carlyle P. Woelfer, Ed.D., Articulation Project Director

Typist - Carla J. Gaiser

INTRODUCTION TO AUTOMOTIVE TESTING

The test items in this guide, which follow each block of instruction, are the result of the joint efforts of the Automotive Instructor, James Sprint Institute, and the Automotive Teachers of the Duplin County Public High Schools. They were in turn reviewed and updated by the State Automotive Advisory and Program Committee in July 1977. This is a type of test item bank and is not considered to be a series of standardized tests.

The majority of the test items are of the performance, competency based type. The non-performance type test items for the most refer to the "Related Technical Information" for the tasks listed for the block of instruction concerned.

These test items are intended for use in determining the ability of the student to perform a given task for a specific block of instruction and meet the appropriate performance standards. This use includes the normal proficiency evaluation conducted by the individual instructor/teacher as well as the centralized proficiency evaluation conducted as proposed in Item 52 of the Policies and Procedures Guide for The Articulation of Occupational Programs Between Public Secondary Schools and The Technical Institutes/Community Colleges of North Carolina - 1978. (Hereafter referred to as the Policies and Procedures Guide - 1978.)

Most of the performance type test items are very simple in form and may not be complete and ready for use since they usually contain only the test item subject or objective and the performance standards, plus those evaluation requirements that should be considered in preparing the test item for administration. The intent in the use of these test items is to provide a series of reliable and valid test items which can be used to evaluate occupational task competency including the ability of the student to meet the business/industry performance standards for the task.

The best format for most performance type test items is that of a job order in which a situation or problem is established that requires student performance of the task to be evaluated. Selection of the proper tools, equipment and material and their correct use are important parts of proficiency determination. Proper preparation of the automobile for task performance, observation of and the correct use of essential technical reference material are also necessary in demonstrating occupational competency. (Sample test item formats are provided on pages following this introduction.) Observation of safety requirements is also rated.

In fairness to the student and to provide the most reliable determination of occupational competency, task performance evaluation should employ primarily performance type test items. The non-performance type test item can be best used to determine the student's knowledge of the essential related technical information pertaining to the task concerned, but alone is normally an inadequate measurement of occupational qualification.

In most cases it is considered appropriate to evaluate student task performance competency for the more complex tasks at the termination of instruction for that task. The simpler tasks which require relatively little time for evaluation often can be grouped for test administration. The instructors should normally conduct instruction for a block in the task listing sequence of the Instructional Objectives Guide with testing following the same sequence. It is not essential that all students be tested on the same task at the same time. Equipment, training items, and tools available usually will limit the number of students that can be performance evaluated on a specific task at any one time. It may be more advantageous to performance test several of the more simple tasks and also test for knowledge of related technical information during one period and then take several periods to test the tasks that are more complex and time consuming. End of semester or quarter testing under procedures discussed above can be limited to evaluation of most recently completed instruction, not yet tested, as opposed to all tasks. Prompt testing reduces recall and skill loss.

The instructional block Student Vocational Skills Record Forms Samples found in the back of the Automotive Instructional Objectives Guide should be reproduced and student progress recorded in the appropriate block and task for the permanent records. In addition, the Occupational Task Performance Record Cards for the Automotive Program (Part I for High Schools and CC/TI: Part II normally for CC/TI only) should be used. One copy is given to the student for his use to maintain a record of his progress and plan for future requirements, while a second copy can be retained by the teacher/instructor and used for his daily recording of student progress. If that is done, the teacher's card is authenticated by the instructor, brought up-to-date and given to the student when he leaves school. The card can be used to show subsequent instructors or employers the instruction completed and the tasks and blocks in which qualified (see Item 54 of the Policies and Procedures Guide). This card is a type of competency based instruction course transcript and should be used to augment diplomas or the local area Certificate of Occupational Qualification to be issued following student evaluation at a centralized testing facility (see Item 52 and Appendices G-1, G-2 and H of the Policies and Procedures Guide). Test items should be prepared for the Centralized Testing Phase as provided in Appendix G-2.

The test items should be reviewed annually and brought up-to-date to ensure that those items which have no value are eliminated and new, improved, valid and reliable items added. Any test item which does not contribute to the determination of task performance competency has no value for the purposes of the automotive occupational program of instruction.

The instructor should have a check list for each performance test item to ensure that the primary skills and related technical information have been demonstrated, all supportive factors considered (safety, preparation, tools, equipment, etc., selection and use) that the task was properly performed and performance standards met. A sample check list follows.

Some tasks are such that task performance ability can be determined by requiring performance of only part of the task, ie: the student grinds one set of valves instead of all in the engine; the student adjusts the brakes on one wheel; the instructor has the job set up so that time is saved by having the student do only the primary tasks. Often performance competency and related technical information knowledge can be determined and time compressed by observing how the student prepares for the task, diagnoses the problem and initiates corrective action. When it becomes obvious that the student can perform the task, action is stopped and the student is questioned orally on how he plans to complete the task. If the response gives evidence of proper procedural knowledge, he can be directed to return the test component to its starting condition to make it ready for the next student to be tested on that task.

Where resources and time for testing are limited, there is also merit to setting up test teams of two students of equal ability to work together on the more complex tasks. Each member of the team is expected to do an equal share of the work and a requirement is stated for the students to alternate frequently as lead mechanic and mechanic's helper. The final evaluation for total task performance by the team would be given to each student comprising the team as if he alone did the total task. It is important in this testing procedure to pair students of near equal ability, or the more apt student would be forced to carry the less competent with less than valid results. The procedure discussed above is just the opposite of a commonly used instructional procedure when it is often desirable to establish two-man teams with competent students being paired with a less competent student to act as coach and pupil.

It is also intended that the test items that follow will be used in proficiency testing (challenge) of students who claim previous instruction or work experience in a given block(s) of instruction and request testing for occupational competency in such blocks for subsequent credit. (See Paragraph 11 and Appendix L, Policies and Procedures Guide - 1978.)

NOTE: With changes made to the Instructional Objectives Guide in 1977, a small number of test items (3 or 4) may not be appropriate or are in the wrong block (road service, heater service, muffler and tailpipe). For 1977 added tasks, there may be no test item prepared, but the pattern and policies remain the same.

PERFORMANCE TEST - AUTOMOTIVE MECHANIC
(Sample)

BLOCK OR DIVISION NUMBER: 0.0 TITLE: Introduction to Automotive Technology

SUB-BLOCK NUMBER: 0.20 TITLE: The Motor Vehicle: Assembly Identification Assembly and Vehicle Mechanical Operation, and Operator Maintenance.

TASK NUMBER: 0.208 TITLE: Know Purpose, Operations, Major Parts and Operator Care of Engine.

Competency Test: (Skill level Objectives)

(.2082) a) The student will identify and state the purpose of the major components of the engine.
(.2083) b) The student will perform operator maintenance of the engine.

Competency Levels:

(.2082) A. Given: 1) a head with valves in place; 2) piston and rod assembly; 3) camshaft 4) intake manifold; 5) exhaust manifold, the trainee will:

1. Identify and state the purpose of the above components.

2. Identify the intake and exhaust valve in the head.

* The trainee will accomplish the preceding tasks accurately within 15 minutes.

(.2083) B. Given: 1) an automobile; 2) several types of oil; the trainee will:

1. Open the hood.

2. Check the oil.

3. Select the proper oil to be used in this vehicle.

* The trainee will accomplish the preceding tasks accurately and safely within 10 minutes.

*Note: Performance Standards

(SAMPLE)

TEST ITEMS

7.0 BLOCK: POWER TRAIN AND MANUAL TRANSMISSION

MODULE: Clutch

MODULE OBJECTIVE: After completion of this module, the student will be able to diagnose and repair any clutch problems to meet manufacturer's specifications in Flat Rate plus 20% time per vehicle.

Given safety procedures, service manuals, manufacturer's specifications, proper tools, and equipment the student will demonstrate the following competencies:

COMPETENCIES OR TASK TO BE PERFORMED AND PERFORMANCE STANDARDS

7.11 Adjust Clutch Pedal Linkage

OBJECTIVE: Given a vehicle, the student will adjust the pedal linkage to an accuracy of 1/16 inch.

7.14 Road test and noise diagnosis

OBJECTIVE: Given a vehicle with clutch bearing or fly-wheel malfunction, the student will road test and correctly describe noise encountered and probable cause and correction required of either clutch bearing or fly-wheel.

7.15 Replace clutch assembly and/or release bearing and fork

OBJECTIVE: Given a vehicle with malfunctioning clutch and/or release bearing and fork, the student will remove and replace clutch assembly and/or release bearing and fork so that proper and smooth engagement and release is provided.

7.08 Replace pilot bearing

OBJECTIVE: Given a vehicle, the student will replace a pilot bearing to provide proper fit as per manufacturers' specifications.

PERFORMANCE TEST ITEM

(Sample)

PERFORMANCE EXAMINATION - AUTOMOBILE MECHANICS

EXAMINER INSTRUCTIONS

TASK: 8.16 & 8.17

JOB # : Inspect, reface and reseat valves in a V-8 cylinder head.

Equipment Required

V-8 Cylinder Head, Micrometers, Dial Indicators, Feeler Gauges, Shop Specification manuals.

Special Tools

Valve Grinding Equipment
Valve Seat Resurfacing Equipment
Valve Seat Stones and Pilots
Valve Spring Tester
Valve Spring Compressor
Cylinder Head Holding Fixture
¼" Electric Drill
Carbon Cleaning Brushes
Straight Edge for checking cylinder head warpage
Lapping Stick and Compound
Safety Glasses
Machinest 6-inch Ruler
Torque Wrench

Time allowed for job - 2 hours.

Use performance rating check list

Note: Based upon Material Published by Central Connecticut State College Vocational Technical Education Program, New Britain, Connecticut (1973).

PERFORMANCE TEST ITEM

(Sample)

PERFORMANCE EXAMINATION - AUTOMOBILE MECHANICS

EXAMINERS INSTRUCTIONS

TASK: 11.26

JOB # : Automotive Electrical Systems - Major engine tune-up including the emission control system on V-8 engine to manufacturer's specifications, using proper procedures as outlined in service manuals.

Equipment Required

1971 or newer vehicle with V-8 engine - Oscilliscope or portable tune-up test equipment. Shop specification manuals (Chilton-Motors-National).

Special Tools

Ignition Wrench Set and Socket Sets - Assortment of screwdrivers
Allen or Sunnen Oscilliscope
Timing Light - OHM Meter - Volt-Amptmeter - Test Light. Tach and Dwell Meter
Remote Starter Switch
Feeler Gauges and Torque Wrench
Distributor Point Tension Tester
Spark Plug Cleaner and Tester
Air Hose and Blow Gun
Droplight and Fender Covers - Wiping Rags
PCV Valve Tester
Battery Hydrometer
Fan Belt Tension Gauge
Vacuum and Pressure Tester
Safety Glasses

Time allowed for job - 3 hours.

Use performance rating check list.

Weight of this job is 60% of total mark.

Note: Based upon Material Published by Central Connecticut State College Vocational Technical Education Program, New Britain, Connecticut (1973).

PERFORMANCE TEST ITEM

(Sample)

PERFORMANCE EXAMINATION - AUTOMOBILE MECHANICS

EXAMINEE INSTRUCTIONS

TASK: 8.16 & 8.17

Job # : Inspect, reface and reseat valves in a V-8 cylinder head to manufacturer's specifications.

Job Objectives: Perform a complete valve job on a V-8 cylinder head.

* This assignment will consist of proper use of manufacturer's specifications and procedures. Proper and knowledgeable use of tools and test equipment. Proper safety procedures. Orderliness and cleanliness of work. Knowledge of task, by demonstration of possession of required skills and related technical information in task performance in time limits.

* Time allotted - 2 hours. (Flat Rate Plus 20%)

This job makes up 40% of total performance exams.

* Note: The performance standards.

Note: Based upon Material Published by Central Connecticut State College Vocational Technical Education Program, New Britain, Connecticut (1973).

PERFORMANCE TEST ITEM

(Sample)

PERFORMANCE EXAMINATION - AUTOMOBILE MECHANICS

EXAMINEE INSTRUCTIONS

TASK: 11.26

JOB # : Automotive Electrical System

Job Objectives: Perform a major engine tune-up including the emission control systems. Bring each system up to manufacturer's specifications.

* This assignment will consist of proper use of manufacturer's procedures and specifications. Proper and knowledgeable use of tools and test equipment. Proper safety procedures, orderliness and cleanliness of work. Knowledge of task performed and completion within allotted time of 3 hours. Must demonstrate possession of required skills and related technical information in task performance.

* Time Allotted - 3 hours. (Flat Rate plus 20%)

This job makes up 60% of total performance exam.

* Note: The performance standards.

Note: Based upon Material Published by Central Connecticut State College Vocational Technical Education Program, New Britain, Connecticut (1973).

(Sample)

TASK PERFORMANCE CHECK LIST
AUTOMOTIVE MECHANIC

STUDENT NAME:		INSTRUCTIONAL BLOCK:							SEM/QTR
TASK PERFORMANCE COMPONENTS RATED	SCORING WEIGHT FOR COMPONENTS %	TASKS (JOBS) NUMBERS							COMMENTS
		(6.15)	(6.16)	(6.17)					
1) Preparation for job - readies vehicle or assembly to work.	(5%)*	(3)	(4)	(5)					
2) Tool and Equipment Selection.	(5%)*	(4)	(4)	(5)					
3) Tool and Equipment Use.	(5%)*	(3)	(4)	(5)					
4) Observation of Safety Rules.	(5%)*	(4)	(4)	(3)					
5) Performs Tests and/or Inspections Correctly.	(10%)*	(8)	(9)	(7)					
6) Identifies the Problem.	(10%)*	(9)	(8)	(9)					
7) Takes Proper Action in Correct Sequence.	(10%)*	(6)	(8)	(10)					
8) Uses Shop Manuals Correctly as Needed.	(5%)*	(4)	(4)	(4)					
9) Uses and Follows Manufacturer's Specifications Correctly.	(15%)*	(12)	(14)	(14)					
10) Quality of Work - (Accurate, Careful, Neat, Thorough).	(5%)*	(3)	(4)	(5)					
11) Performs Task Correctly in Flat Rate plus 20% Time.	(10%)*	(8)	(8)	(10)					
Score for Work Methods (1 - 11).	85% *	(64)	(71)	(77)					
Score for Finished Task.	15% *	(12)	(14)	(14)					
Task Qualified (80%).	100% *	(76)	(85)	(91)					

* (Sample Only - Determined by Committee)